ARMY ORDNANCE

VOL. XXVIII, No. 150 MAY-JUNE, 1945

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MAY 1 6 1945

GENERAL JOSEPH W. STILWELL

". . no trick solutions, no cheap short cuts."

A REVIEW OF INDUSTRIAL PREPAREDNESS FOR NATIONAL DEFENSE
PUBLISHED BY THE ARMY ORDNANCE ASSOCIATION, WASHINGTON, D. C.

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WITH THE Sperry Gyrosyn Compass you can do just that! It gives dead-beat indications . . . accurate magnetic headings . . . is without northerly turning error, oscillation or swinging. And it does *not* require resetting.

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COMMUNICATIONS

MR. MATSON AND THE 40-MM. GUN

THE EDITOR.—Your publications are excellent material to promote ordnance research and development and to tie Army Ordnance and American Industry into a great unbeatable team. Many men in my company, Chrysler Corporation, are members of the Association, foremost among them being Mr. K. T. Keller, our president.

Since my father is a newspaper writer and editor in Dayton, and my brother is an Associated Press editor in Washington, I know personally how hard you editors strive for absolute accuracy and how you welcome notification of the very few slightly inaccurate statements which slip through even the most careful editing and copy reading.

In fairness to the men who made possible the mass production of successful 40-mm. antiaircraft guns (M1), the fifth paragraph on page two of Army Ordnance Bulletin No. 52 possibly should have mentioned Mr. H. A. Matson, head engineer, Office of the Chief of Ordnance, U. S. Army, who was in direct charge of the 40-mm. gun program for the Army, and the Chrysler engineers who actually did the engineering work of converting the Swedish Bofors gun to the present Army M1.

The writer has been working exclusively on the conversion and redesign of 40-mm. guns an average of fifty-five hours a week since January 1941, and throughout the entire period Mr. Matson has given us the most excellent coöperation possible for any one to give. His good judgment, his engineering knowledge, his ability to get things done, and his wonderful personality are worthy of a paragraph or two in your Bulletin, even though he was overlooked in passing out Civilian Service Awards on the last round.

Mr. August Dabrasky, who is a worthy recipient of the award as mentioned in the Bulletin, has done a fine job of supervising Firestone in the design of the 40-mm. gun mount, but did not have any connection with the conversion of the Bofors gun drawings to the Army 40-mm. gun T1, later to M1. As a result of the error in the giving of credit you have lost some of your reader-friends and have indicated to others that the Bulletins are not always correct.

In all fairness you should insert a correction in your next Bulletin, giving Mr. Matson the credit he so richly deserves for his splendid work on gun mechanisms. In this way you will win back the lost reader-friends, you will convince all readers that you do truly strive for absolute accuracy in all your publications, and you will impress the Association members and many others with the authenticity of the Bulletin material.

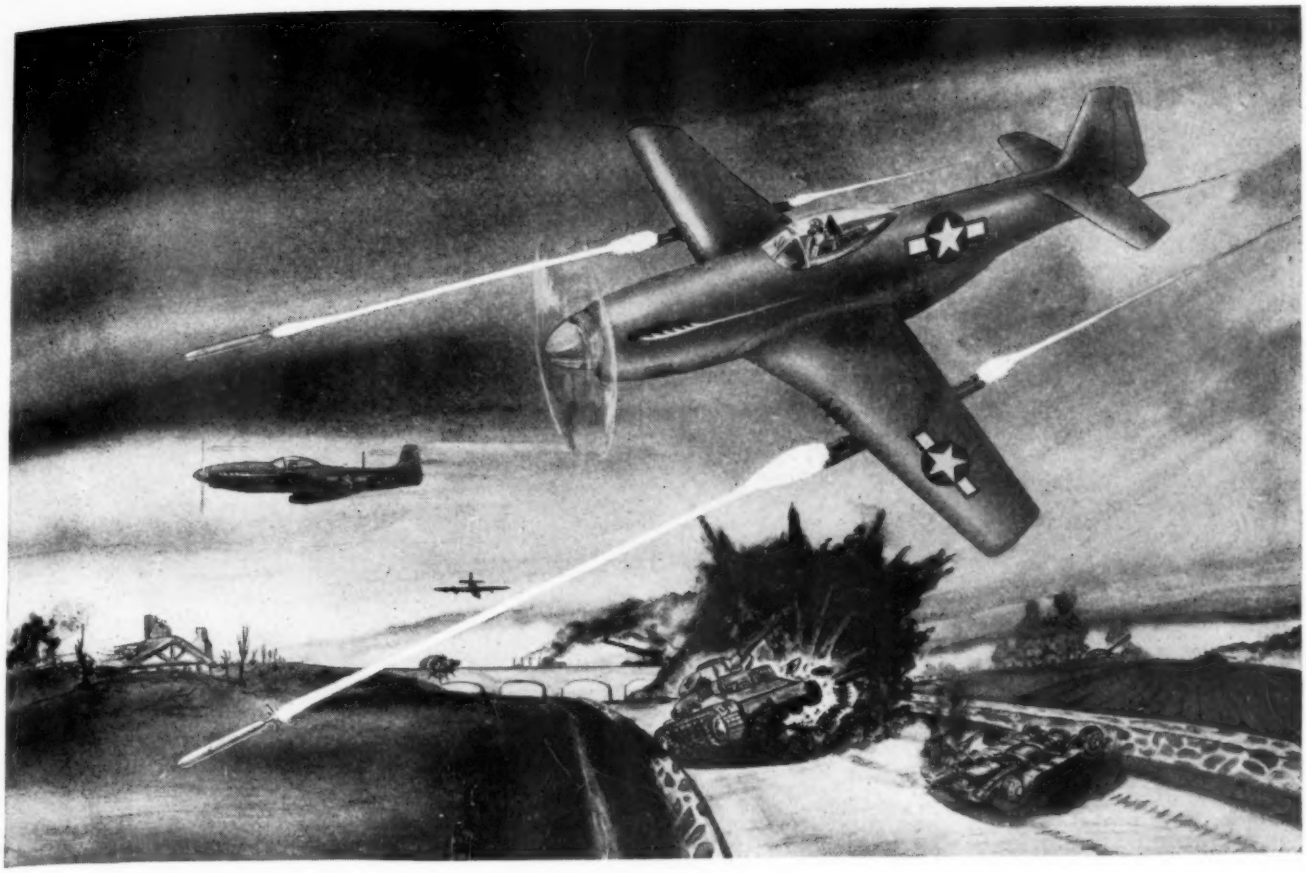
J. A. KANY
Detroit, Mich. *Automatic Cannon Engineer, Chrysler Corporation*

▪ In an effort to achieve that "absolute accuracy" for which Mr. Kany assures us we are striving, we are delighted to publish here where space allows, rather than in the Bulletin, the above comments on Mr. Matson and the 40-mm. gun.—EDITOR.

POSTWAR THOUGHTS FOR ORDNANCEMEN

THE EDITOR.—I have a couple of ideas relative to the change-over from war to peace which I wish to present for your consideration. I would permit Ordnance soldiers and officers to purchase, at reasonable prices, sufficient hand tools and small

(Continued on p. 328)



Flying Fury

Roaring high in the sky, fighter planes of our armed forces wing their way to their objectives. Cradled under each of their wings are rocket launchers loaded with destruction for the enemy . . . Six deadly missiles that spell doom to the foe and his equipment.

These rockets are launched by fighter planes such as the P51 Mustang (shown in illustration) while coming in at their targets at terrific speeds. They are also projected from ground emplacements and ships of all sizes.

THE CONTINENTAL DIE CASTING CORPORATION

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Has been in mass production for many months supplying our fighters with these rockets being used so successfully against our enemies in both the European and Pacific Theatres of war.

Such precision accuracies were demanded in the production of these rockets that special techniques were necessarily developed to meet the mass production schedule set for the worker-fighters (79% of whom are women) of the Continental Die Casting Corporation. The devolopment and use of new heat treating procedures made possible machining before heat treatment, holding close tolerances without distortion.

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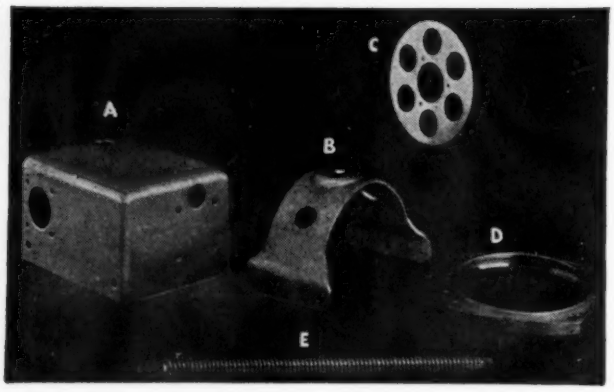

a—Yoke for Electrical Gyro
b—Bezel for Turn and Bank Indicator
c—Control Block for Actuating Units
d—Averaging Gear for Averagizing Unit
e—Jack Screw for Actuators

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No better example of the versatility of LEA Finishing Methods and of the effectiveness of LEA Finishing Compositions can be found than in these five items made by The United States Time Corporation.

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THE LEA MANUFACTURING CO.

Waterbury 86, Conn.

Burring, Buffing, and Polishing . . . Manufacturers and Specialists in the Development of Production Methods and Compositions

Communications

machinery to permit them to continue doing mechanical work after being released from the Army. I also would provide for free transportation of any tools so purchased, up to a limit of 500 pounds, from point of purchase to the home of the purchaser.

For those who do not intend to go into business for themselves as mechanics, I believe that they should be given preference at permanent Ordnance Department installations. To officers and enlisted men of the Ordnance Department who entered service prior to December 7, 1941, I would give preference over civilians who had started work for the Ordnance Department between October 1, 1940, and December 7, 1941. Men who came into the service since December 7, 1941, should have preference over civilians who commenced working since that date.

I also believe that the men who have been overseas the longest should be the first released from the service, even if it means that men in the States would have to be sent over to replace them. I have had a year of foreign service and I would be more than willing to go again if it would bring some of the men home who have been gone so long.

MAJ. PAUL L. PURVINE, *Ord. Dept.*

Fort Bragg, N. C.

■ **Major Purvine's idea for the disposition of surplus tools looks pretty constructive from where we sit.—EDITOR.**

GOOD SHOOTING, GOOD ORDNANCEMEN

THE EDITOR.—In Bulletin No. 49 you give a report from Lieut. Col. William R. Kintner on "Good Shooting—Good Ordnance." This report does not amaze me, inasmuch as I served under Colonel Kintner when he was a captain and S-3 of a special battalion training to take over any kind of artillery, and I was master gunner for the unit.

It was a fine accomplishment to train successfully a group of men so that they could take over any type of gun, with any type of obturation and firing mechanism, and every system of fire control—from 3-inch to 16-inch seacoast. And a lot of our fire-control instruments were homemade affairs!

You can realize what the men could do once they got real, up-to-date equipment; for equipment is as good as the men who man it, and to Colonel Kintner goes a lot of credit for the plans and training programs, as well as to our farsighted and understanding commanding officer, now Brig. Gen. O. A. Nelson.

M. SGT. DOUGLASS M. HOWELL,
Master Gunner

Somewhere overseas

■ **Well said, Sarge! Good Ordnancemen make good shooting possible.—EDITOR.**

"SELF-SATISFACTION STYMIES RESEARCH"

THE EDITOR.—We Ordnancemen in the field feel that your optimistic Bulletin No. 46 would have been a better Bulletin if it had not printed so many things that are not so.

Perhaps it would be well to get the facts from the pundit quoted in the first item on "American Armor." Armament research must be based on facts, not wishful thinking, if it is to succeed. Self-satisfaction stymies research and development.

Suggest that your statements about the M29 cargo carrier (the "Weasel") be checked for accuracy as well as the item mentioned above. We repair them in the field—we know.

LIEUT. COL. ROBERT A. HUDSON, *Ord. Dept.*

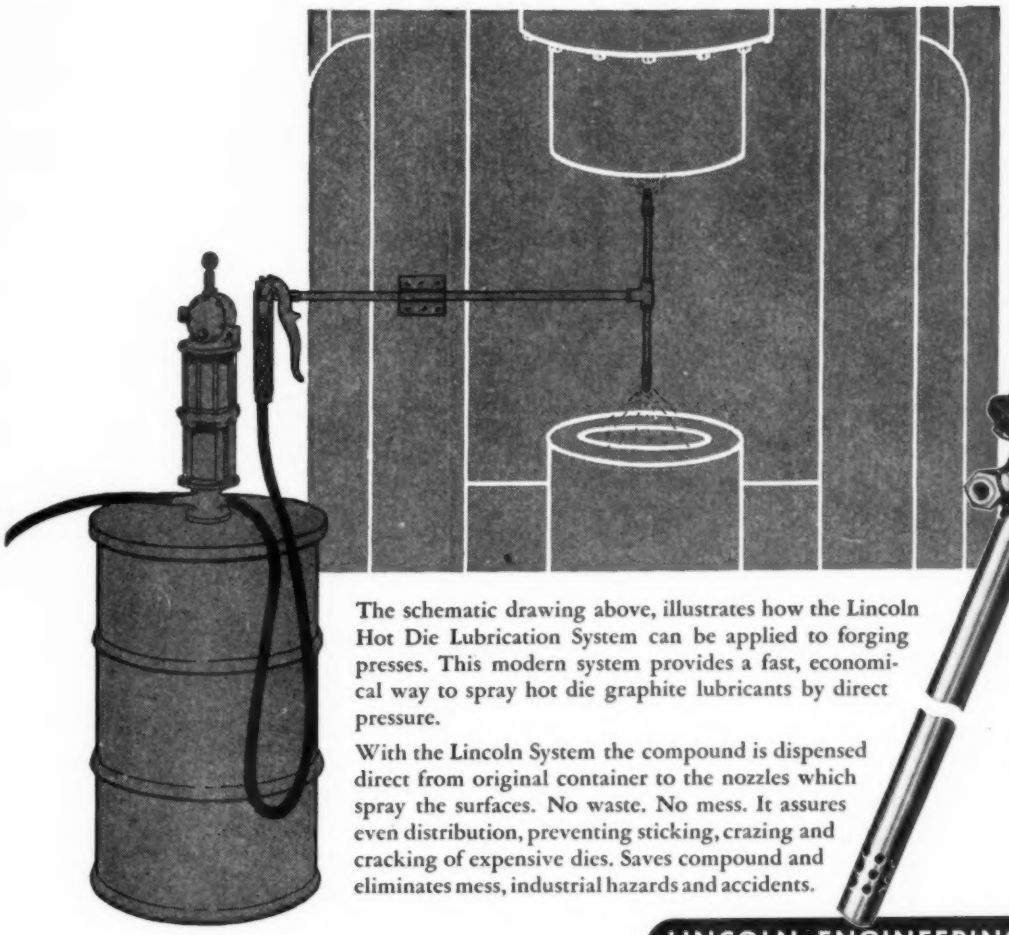
Somewhere in Germany

■ **We admit, with a wince, that we really appreciate such criticism. It would be equally helpful, though, if the Colonel would tell us just what is wrong with American armor and why the Weasel is not as advertised. Who knows—some one might read about it, and even do something about it.—EDITOR.**

Don't SWAB HOT DIE SURFACES BY HAND...

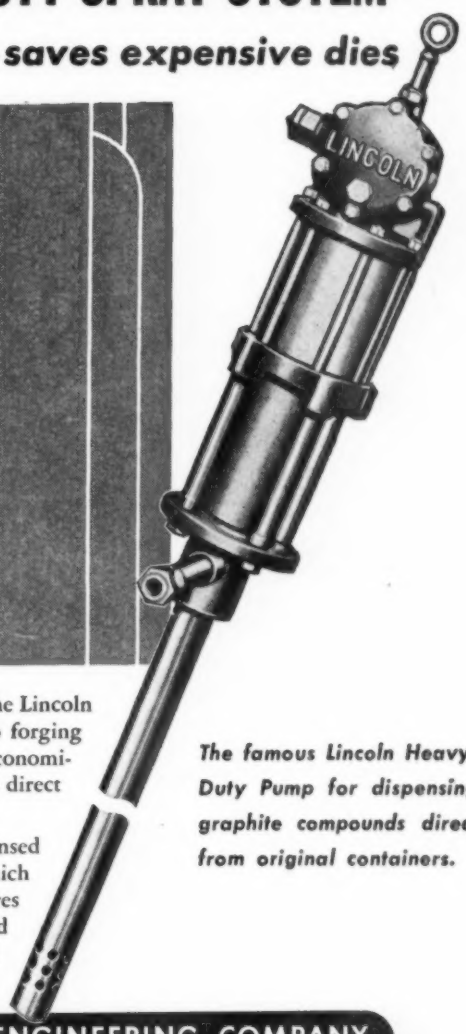
Install a LINCOLN HEAVY DUTY SPRAY SYSTEM

speeds production—saves expensive dies



The schematic drawing above, illustrates how the Lincoln Hot Die Lubrication System can be applied to forging presses. This modern system provides a fast, economical way to spray hot die graphite lubricants by direct pressure.

With the Lincoln System the compound is dispensed direct from original container to the nozzles which spray the surfaces. No waste. No mess. It assures even distribution, preventing sticking, crazing and cracking of expensive dies. Saves compound and eliminates mess, industrial hazards and accidents.



The famous Lincoln Heavy-Duty Pump for dispensing graphite compounds direct from original containers.

Mail Coupon for Complete Information

Today, with production on hot die forgings at an all time high, many plants have installed these Lincoln Systems. The installation is simple and pump can be located at a point remote from press if desired. Our engineers will gladly make recommendations. The coupon at right is for your convenience.

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We are interested in Spraying Hot Die Lubricants. Have your representative call.

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Pioneer Builders of Engineered Lubricating Equipment

LINCOLN

"Forget something, Soldier?"

In your haste to repair shot-up equipment and get it back into action, don't forget the bearings. Make sure they're clean . . . that they're correctly installed . . . that they're properly lubricated. A *little* thing like a bearing can make a *big* difference in a battle.

5764

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SKF
BALL & ROLLER BEARINGS

New Developments

ORDNANCE SNOW CRUISER

Ordnance has developed a new full-track snow cruiser for the Air Forces to be used in deep-snow country for towing and light cargo hauling. This transport vehicle, when loaded, weighs 2½ tons, has a speed of 20 miles an hour, a cruising range of 100 miles, and a unit ground pressure of only 0.84-pound per square inch. Maximum tractive effort is 5,000 pounds. The snow cruiser uses the suspension type running gear with 14 wheels, while the type of track is an endless 6-ply fabric belt. The number of shoe tracks is 27, with a width of 2 feet. Powered by a 90-horsepower gasoline engine, the snow cruiser is about 14 feet long, 6 feet high, and 5 feet wide. It has successfully negotiated snow 50 feet deep.

FEATHERWEIGHT BAZOOKA

A featherweight bazooka with a heavyweight punch and a new "eye" sight is now in production for the Army. Weighing 10½ pounds—42 per cent lighter than the standard model—the new bazooka may be handled as easily as a regular Army rifle.

This is the seventh basic design of the weapon, forerunner of all combat rocket launchers in this war. The first model bazooka had a single-piece barrel with a permanent rear sight, similar to that of an ordinary gun. Next came a streamlined take-apart model, commonly known as the folding bazooka, and designed for use by paratroopers and infantrymen fighting in jungles and thick underbrush. This model had no sights on the barrel but was equipped with a collapsible, single-element bar sight mounted on the side of the bazooka.

The latest design has an optical sight on a folding mount. The design and construction of the sight provides unrestricted vision when leading fast-moving targets such as tanks. An elevation adjustment eliminates the conventional sights used on Army rifles. This sight has increased the accuracy of the bazooka to such an extent that now an infantryman may qualify as a "bazooka sharpshooter" for which he is awarded a sharpshooter's medal upon which is mounted a replica of the weapon.

Another development includes the replacement of dry-cell batteries with impulse generators for firing the rocket launcher. The present model is also equipped with a 2-position stock for firing when standing or kneeling, and lying down.

American troops on the Western Front have found a new use for the versatile bazooka rocket. They now use it with telling effect to smash through barbed-wire entanglements. Although the standard bazooka fuze will detonate only against tanks or other hard surfaces, the bazooka men have been able to sensitize the fuze by lowering the tension of its spring so that it will function on even one strand of barbed wire.

CONCRETE-PIERCING FUZE

American artillery pounding the eastern Rhineland and Jap fortified positions in the Philippines are using a new concrete-piercing fuze. The new fuze can be screwed on the nose of every artillery projectile from a 75-mm. gun shell to a massive 240-mm. howitzer shell. This unique interchangeability feature is another of the achievements of the Ordnance Department.

The new fuze is strong enough to permit the shell to pierce certain types of pillboxes or other concrete fortifications before the explosion occurs. It is also sufficiently accurate to permit a fraction of a second's delay before the shell, embedded in the concrete, blows a section of thick masonry into a million pieces.

(*Continued on p. 332*)

SOLAR

CAPACITORS...

Trustworthy in every climate

SOLAR PRODUCTS

DRY ELECTROLYTIC CAPACITORS
WET ELECTROLYTIC CAPACITORS
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Heavy duty trucks for the U. S. Armed Forces are handled at the most efficient production speed on this Conveyor System engineered by Alvey-Ferguson.

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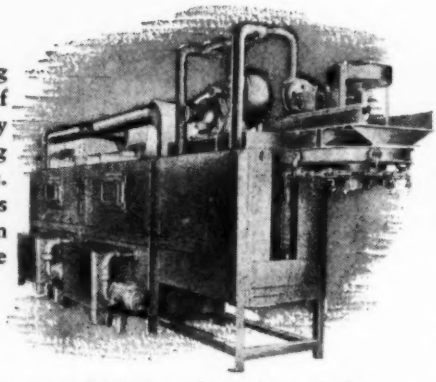
This A-F Cleaning Machine consists of wash, rinse and dry units for cleaning incendiary bombs. A vent system draws off all vapors from wash and rinse sections.



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Write for newest folders showing A-F Engineered Conveyor Systems and A-F Metal Cleaning and Finishing Equipment in war plants and arsenals.

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CONVEYING EQUIPMENT
A-F Alvey-Ferguson
METAL PRODUCTS CLEANING & FINISHING EQUIPMENT

New Developments

Where armor-piercing shells had formerly temporarily knocked pillboxes out of commission without destroying them completely, shells equipped with the new fuze reduce them to rubble. The new fuze makes it possible to convert a regular high-explosive shell into a concrete-piercing round and thus obviates the necessity of manufacturing a special-purpose concrete-piercing shell. For more detailed information, see Colonel Eddy's article in this issue.

ORDNANCE CURB SERVICE

Army Ordnance is now giving Gen. Douglas MacArthur's fighting men throughout the Southwest Pacific island area the same curbstone automotive repair service long rendered General Eisenhower's spearhead armored units in Germany. Instead of bringing damaged automotive equipment to Ordnance shops, Ordnance is sending huge floating shops to island bases. This novel plan saves precious time and critical shipping.

Some months ago, huge concrete ocean-going barges were converted into floating shops. Towed from island bases by either Liberty ships or ocean-going tugs, the floating shops are put into operation within twenty-four hours after arriving at a new destination. Over a period of a year, the engine-reconditioning barges will turn out more than 10,000 rebuilt engines and a proportionate number of power-train and electrical assemblies. The tire-reconditioning barge will retread, vulcanize, and repair some 400 tires each working day. The new program will not result in the abolition of previous maintenance programs. Where large concentrations of troops and upward of 75,000 vehicles exist, land-based shops will be established. The floating shops, manned by specially trained soldier-mechanics of the Ordnance Department, will service the smaller bases in the rear areas and newly won advanced positions.

The barges are 269 feet long and 48 feet wide. Eight holds provide more than one hundred thousand cubic feet of storage space. Reënforced superstructures cover more than 8,000 square feet of concrete deck space for shop installations. Silent electric cranes serve each hold. When docked, extensions of the crane tracks are lowered over the dock to pick up assemblies and supplies to feed the assembly lines. Antiaircraft guns protect the vessels from air attack.

PROTECTION FROM FLASH BURNS

A flash-burn protective cream has been adopted by the Quartermaster Corps to reduce the chance of flash burns for tank crews and soldiers using bazookas and flame throwers. It is issued in a small round container, convenient for the pocket, containing 4½ ounces of the flame-resistant cream. Simple directions for its application are printed on the cover.

"Cream, protective, flashburn," as it is known in Army parlance, does not possess any medical properties and will not cure burns. Its prime function is to provide a "fireproof" protection for exposed parts of the body against burns from sudden flashes of flame.

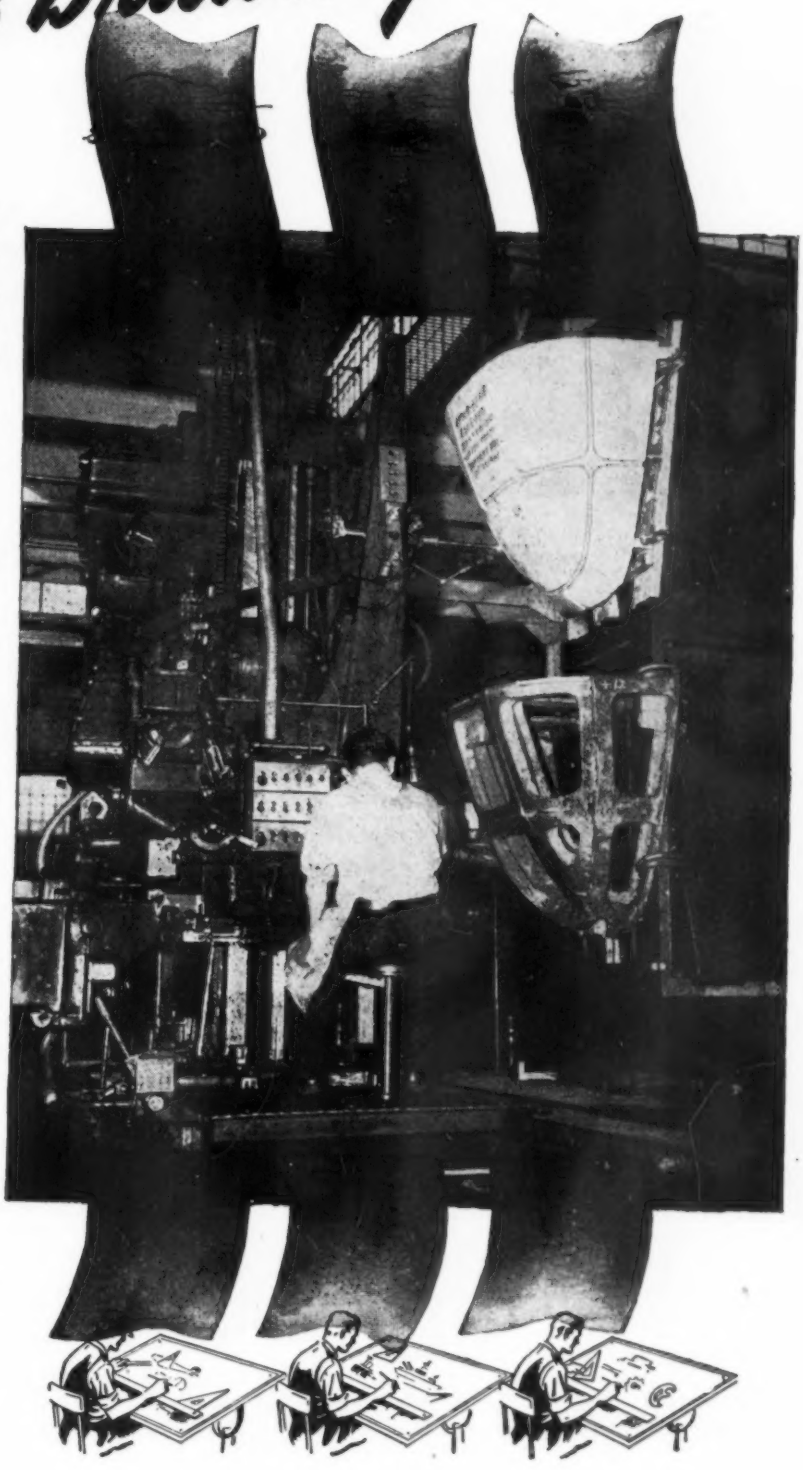
JET-PROPELLED FIGHTER PLANES

The Army Air Forces has revealed a few details about its first jet-propelled combat plane, the P-80, built by Lockheed. Known as the "Shooting Star," it is believed to be the fastest fighter in existence.

Army and industry coöperated in building the first P-80. In July 1943, the Air Technical Service Command at Wright Field turned over to Lockheed a British jet engine built by De Haviland, patterned on the basic principle invented by British Air Commodore Frank Whittle, and asked that a suitable airframe be built around it. Company and AAF engineers set to work on the plans, and in 143 days the first model had been designed, constructed, and flown—a job that normally requires a year and a half. Subsequently, engines manufactured by General Electric were adopted to power the P-80. (*Continued on p. 334*)

Up from the Drawing Boards

The P&W Keller is proving invaluable in turning out parts and pilot models for new and vital war equipment.



Bigger, more powerful airplanes, new inventions, changes in design, advanced models . . . all of these are flowing daily from America's drawing boards into experimental models and actual production lines.

Bridging the gap in thousands of instances is the Pratt & Whitney Keller machine . . . the "machine with a brain" which transforms wooden or plaster models into finished steel experimental parts with speed, economy, and accuracy.

The Keller can make up any shaped part within a range of 2.5′ x 6′ x 12′ out of a plain slab of steel or Duralumin or similar metals. It can work in two or three dimensions. It side-steps costly tooling, expensive dies. Most important, it hastens the arrival on the fighting fronts of new and vital equipment which can help shorten the war.

Built with the precision for which Pratt & Whitney is famous, the Keller has an inherent long life and dependability. And it is equally at home turning out the products of peace . . . no conversion one way or the other. Full particulars on the scope and versatility of the Keller will be mailed upon request.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

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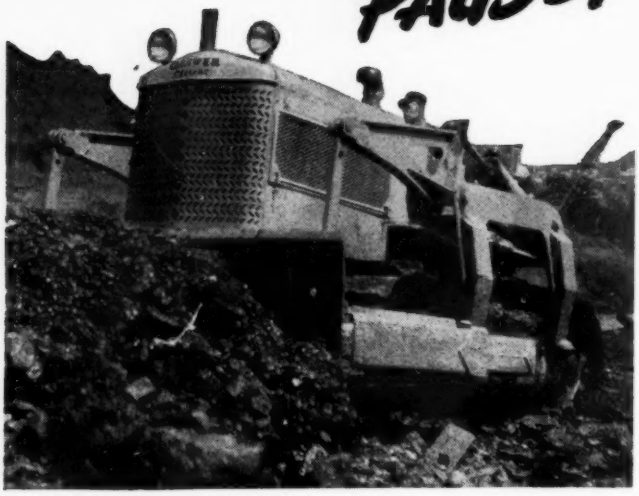
The PUSH that doesn't PAUSE!



● They keep pushing! That's why Oliver "Cletrac" tractors move heavier loads . . . faster . . . more economically. Both tracks keep working all the time . . . on the turns as well as straightaway. There's no pause in the flow of pushing power. For only Oliver "Cletrac" gives you *controlled differential steering.*

On any job, push or pull, Oliver "Cletrac's" controlled differential steering principle provides these outstanding advantages. Off-center loads are handled with ease. There's no need to "de-clutch" or "brake" when turning, providing greater safety on hills and slopes. Oliver "Cletracs" don't zig-zag. They steer the same going downhill as up. Power is never disconnected from either track.

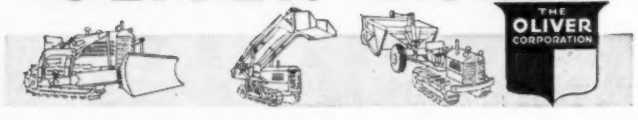
These husky tractors offer other equally important features. And because they are unusually accessible, maintenance is a simple task.

Substantial numbers of Oliver "Cletrac" tractors are now being released for essential use. Your Cletrac dealer will gladly assist you in making application for a new tractor.

The OLIVER Corporation

Industrial Division: 19300 Euclid Avenue • Cleveland, Ohio

OLIVER - Cletrac



New Developments

The airplane is powered by a single gas-turbine engine. Air is drawn through intake ducts and screened. It then flows through a compressor of the turbine into a chamber where it is heated by a burning fuel similar to ordinary kerosene. The rush of hot gas revolves the turbine to turn the compressor. Gas rushing out through a huge nozzle at the rear of the fuselage propels the plane.

The "Shooting Star" is extremely maneuverable through use of a hydraulic aileron boost and electrically operated flaps. It can carry heavy loads of ammunition, photographic equipment, bombs, and fuel. The pressurized cabin, unique among production fighters, is equipped for pilot "G" (antigravity) suits to ease the discomfort of sharp turns and pull-outs.

Extremely important is the simplicity of design and construction of the P-80. With the propeller, radiator, cooling system, superchargers, carburetor, and all the complex controls of these items in a conventional model absent, the result is a plane that is remarkably easy to build, service, and repair. The engine can be replaced completely within fifteen minutes, compared with the eight or nine hours required for engine change on the standard fighter.

In addition to production at four Lockheed plants, the plane is also being built at the Kansas City factory of North American Aviation, Inc.

The ultrasmoothness of all external surfaces of the Shooting Star is achieved largely through the use of a proprietary Du Pont airfoil pyroxylin lacquer which is buffed and rubbed to polished-glass smoothness. To reduce air resistance further, all external rivets are countersunk and machined. Aircraft-type putty is used to fill all dents and cracks, and over this a liberal coat of surfacer is applied and rubbed, sanded, and polished. Finally, the airfoil lacquer topcoat is sprayed, buffed, and polished, effecting a glasslike finish.

A BRITISH jet-propelled fighter aircraft is the Gloster Meteor. These Meteor jet-propelled fighters were first employed by a squadron of the Royal Air Force Fighter Command against flying bombs launched by the *Luftwaffe* last summer from France. The RAF Meteor proved to possess speed greatly superior to the pilotless German flying bomb, and many tactical lessons were learned from these early combats.

Like the Gloster E 28/39, which was the first turbine jet aircraft in the world to fly (May 1941), the Meteor is also a production of the Gloster Aircraft Company (Hawker-Siddeley group). It is powered with Rolls-Royce engines manufactured to the basic design of Commodore Whittle of the RAF, collaborating with Power Jets, Ltd., and the British Thomson Houston Company, Ltd.

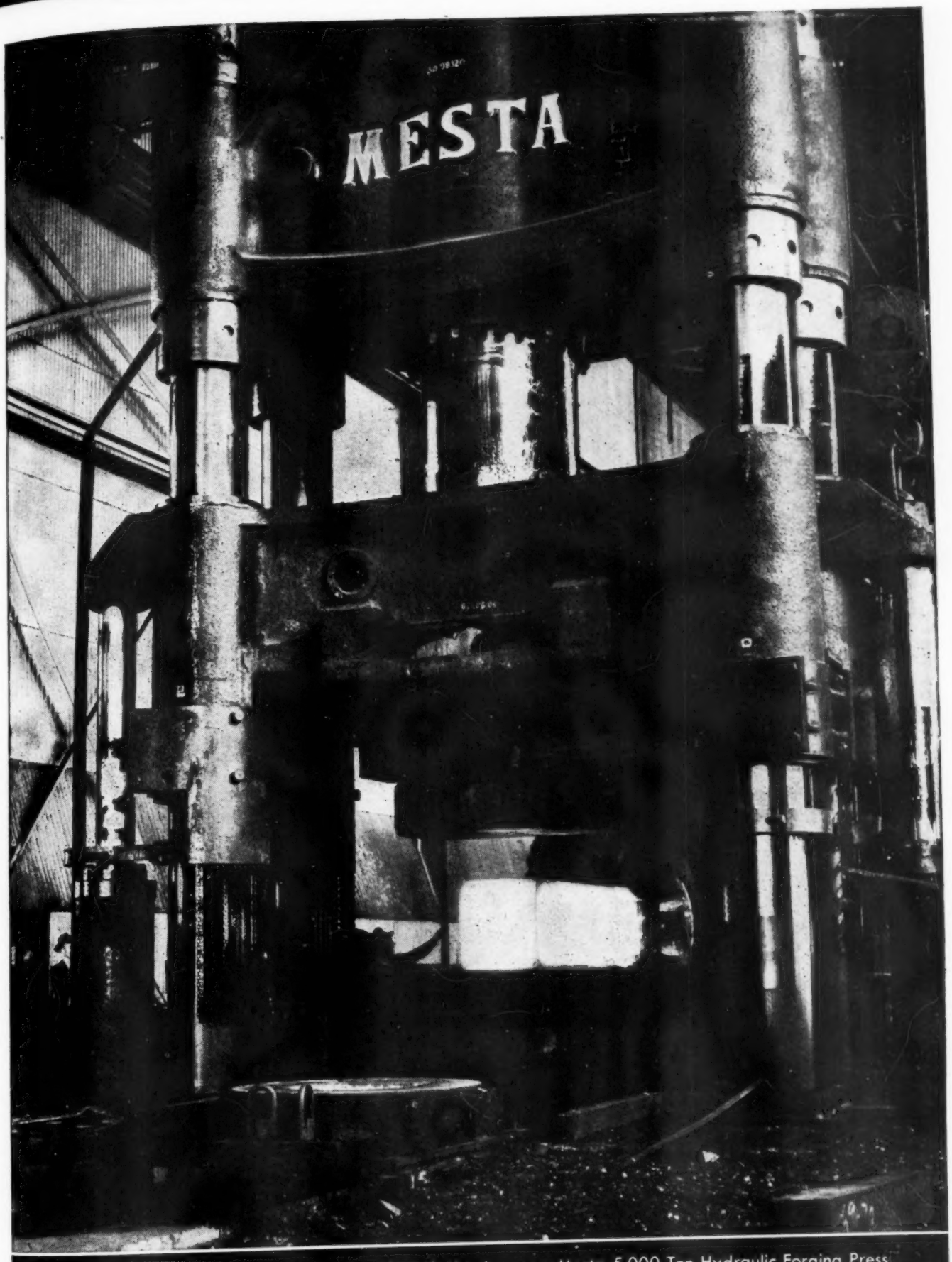
In addition to the Meteor, Britain has another jet-propelled fighter in an advanced state of development. This has been designed by the De Haviland Aircraft Company, Ltd. Its engines are also manufactured on the basic principles used by Commodore Whittle.

Germany has two jet-propelled planes—ME-163 and ME-262—the principal characteristics of which are as follows:

ME-163.—Single-engine, single-seat midwing monoplane resembling an arrowhead. Wings sharply swept back; short teardrop fuselage; tall single fin and rudder. Span, 30 feet; length, 20 feet; speed, over 500 miles an hour. The 163 is rocket type, employing a single liquid rocket-propulsion unit. The endurance at full power is reported to be only a few minutes, but the jet may be used intermittently.

ME-262.—Single-seat, twin-engine, low-wing monoplane. Wings are tapered with squarish tips. Slim fuselage has a long nose, with cockpit placed over the wing. Span, 41 feet; length, 35 feet, 5 inches; speed, over 550 miles an hour. In contrast to the rocket-type 163, the 262 is a true jet-propelled fighter with two jet units.

(*Continued on p. 336*)



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AUTOMATIC AIRCRAFT GUN CHARGER

An automatic gun charger that "thinks for itself" in preventing failure of aërial machine guns because of defective rounds of ammunition has been developed by the General Electric Company for the B-29 Superfortress, P-61 Black Widow, and other new airplanes. This device initially cocks the plane's guns, will recognize an ammunition failure, help dispose of a defective round, and insert and fire a new one. If a gun repeatedly fails for approximately eight successive rounds, it will "decide" that something is radically wrong and will stop all further operation of that gun.

The gun charger consists of three principal units: charging, firing, and timing. The firing unit fires the gun normally, the timing unit determines when to charge the gun in case a defective round occurs, and the charging unit clears ammunition malfunctions. The device is operated under high air pressure from a turret-mounted compressor.

NEW MAMMOTH AIRCRAFT

Details of a new transport plane, weighing 92 tons and capable of carrying 149 passengers, recently have been disclosed by Pan American Airways. Known as PAA Type 10, the aircraft is designed for a range of 3,500 miles and a cruising speed of 288 miles an hour using only 64.3 per cent of normal power at 25,000 feet altitude. Its 4 engines would be rated at 3,500 horsepower each for take-off, and 2,800 normal.

In transatlantic operations, Pan American proposes to carry 128 passengers by day and 119 at night, the latter arrangement including berths for 30 persons and 89 seats. The crew of 11 will include 4 pilots, 3 stewards, 2 radiomen, a navigator, and a flight engineer. The huge plane's empty weight is listed at 118,794 pounds, permitting a useful load of 65,206 pounds. The cargo capacity is 2,082 cubic feet. The cost of the plane has been estimated at $2,029,488, compared with $1,412,488 for the Douglas DC-7, which PAA refers to as Type 9. The DC-7 is listed at 162,000 pounds, a maximum of 108 passengers, with an operational capacity of 95 by day and 79 by night for transocean flights.

Huge new bombing planes are under flight tests by various service branches and, if successful, would dwarf the B-29 Superfortress. Included in the group are the B-35, B-36, and B-42. The B-36 is described in Congressional testimony recently made public as the largest airplane attempted in this country. One wind tunnel at Langley Field, Va., has been devoted to testing the B-35 and also the B-36 for more than a year.

THE "EARTHQUAKE" BOMB

The Royal Air Force has been breaking dams, seawalls, and submarine pens recently with a new type 12,000-pound "earthquake" bomb that it described as "undoubtedly the most destructive air weapon ever used."

The new bomb is three times the size of the original blockbusters, one of which is known to have destroyed at least thirty buildings during an attack on Emden. That would mean that under the same conditions the "earthquaker" might flatten up to one hundred buildings. Its blast damage has been estimated to cover an area of approximately 80,000 square yards.

ARMY ORDNANCE

THE JOURNAL OF THE ARMY ORDNANCE ASSOCIATION

Founded 1920

For Victory through Armament Research, Production, and Supply

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If it were a practice to dedicate an issue of ARMY ORDNANCE to some one subject or some one person, this issue would be dedicated to the man whose likeness appears on the front cover, Gen. Joseph W. Stilwell—fighter par excellence and champion of the American foot soldier. The cover drawing was done especially for ARMY ORDNANCE by LeBarron Coakley, well-known Washington illustrator.

The dedication would read something like this: "To 'Uncle Joe' Stilwell for what he has done and is doing as a fearless champion of the American infantryman, the rifleman, the artilleryman, and all the other ordinary everyday soldiers we have come to know simply as GI Joes."

The time has come for straight thinking and shooting about some of the simplicities of our own military situation—the full utilization of man power in military and civilian fields, the strikes, the slowdowns, the squandering of the taxpayer's money raised in the fervor of War Bond sales.

But General Stilwell is the antithesis of all such stupidity. He is a frank, selfless, capable fighter. Because he is what he is and because he has done what he has to bring the slugging foot soldier back to his rightful throne (read his article on page 385) we humbly and gratefully say, "Thank God for Uncle Joe." He stands for the best in the American Army because his mind is not on the stars but in the mud with those millions of Joes, his affectionate fighting nephews.

—The Editors

Vol. XXVIII **MAY-JUNE, 1945** **No. 150**

Copyright 1945 by the Army Ordnance Association, publisher, 705 Mills Building, Washington 6, D. C. Issued bimonthly. Single copy, 75c (by mail). Subscription rate: continental U.S. and possessions, $4.50 annually, in advance. Entered as second-class matter, August 14, 1920, at the Post Office at Washington, D. C., under the Act of March 3, 1879. Additional second-class entry at the Post Office at Richmond, Va. Three weeks' notice is required to effect change of address.

David and Goliath—1945

Infantry Gets the Decision

The Ground Troops Must Conquer and Hold Territory

Gen. Joseph W. Stilwell

PRESUMABLY you knew when you asked me to come to Cleveland that I was connected with the Army Ground Forces. Don't be surprised, then, if I bear down somewhat on that subject. And don't misunderstand my feelings of the Navy, Marines, and Air Forces. The Navy got up off the canvas after Pearl Harbor and while still groggy fought back to such good effect that now they have made the Japs jump right out of the ring. It has been a monumental job to regain control of the Pacific.

The Marines are even now proving once more what they have already proved many times—that they are a fighting outfit and on top of any job you hand them. The accomplishments of our Air Forces in training, development, and transport, as well as combat, are too well known to require further emphasis. Our service forces are conducting in all quarters of the world the greatest and most complicated business in history.

Also present are the Army Ground Forces, the bulk of our fighting strength, which we have come to take somewhat for granted. These are the sluggers who are at it all the time, day and night, in all weathers. These are the troops that get the decision. The location of the man on foot struggling forward with the help of artillery, tanks, air, his own supporting weapons, and all the services is still the gauge by which we measure success or failure. If he gets forward, we win. If he is forced back, we lose.

All our inventions, all our machines, all our weapons, all our efforts are centered on getting the man on foot forward. The reason is simple enough. He is the only agency that can hold ground. So modern war, like ancient war, boils down to the attempt of the ground forces to go forward in spite of everything—fatigue, fear, wounds, and death.

We are beginning to realize that no matter how a war starts, it ends in the mud. It has to be slugged out—there are no trick solutions, no cheap short cuts. Any promise of a quick, cheap, or easy method has always had a strong appeal, and naturally so, war being what it is.

Those of the military profession who opposed such views have, in the past, come in for considerable panning. The remarks hurled at them ranged from "narrow-minded," or "one-track mind," to "ossified," "die-hard," "stuffed shirt," and other more vivid expressions together with charges of stupidity and laziness. They were harshly criticized for not keeping up with the times.

The appearance of the submarine was at first generally thought to spell the doom of all surface ships. The machine gun was to make attack impossible. The tank was to make defense hopeless. Gas was going to annihilate whole populations. And the airplane was going to do several of these things.

THIS tendency still hangs on. Only this morning I read that somebody was much concerned about the danger of a collapse of civilization due to the jet plane and the buzz bomb. But it has become apparent to most of us that what we need is not an overwhelming superiority in any one weapon, promising as it may be, but a well-balanced force of all of them. Listen to one of our leading popular commentators:

"The morale of a people on the defensive is evidently not cracked by air power alone. The ground troops and their artillery must be relied on in the old-fashioned way to gain territory and crush the enemy. It's a vindication for the old-fashioned admirals and generals who were ridiculed earlier in this war as being 'behind the times.'"

Now that we are getting this more realistic view of the all-important rôle of the Ground Forces, I hope to see more attention paid to the lads who are carrying the ball. How the writers are going to make a glamorous hero out of a muddy and dilapidated GI with two weeks' whiskers and a barnyard aroma on him, I don't know. That's *their* job, and they had better work it out, or circulation is going to fall off.

There are going to be a whole lot of these lads who won't cheer every time they read the magazine story about how the captain aviator made off with the gal. They will want the bazooka man or the No. 2 scout to win, too.

The average GI is a pretty intelligent person, and usually he knows the score. We try to explain the why and wherefore of the war to him in a course of orientation, but no matter how much instructional material you hold out to him he remains a realist. The conditions under which he lives make him one necessarily. So his primary concern in action is indicated by his daily prayer, "O Lord, distribute the bullets as You do the pay: Let the officers get most of them." His next concern is to come home and get back to the old familiar scenes.

When he does, do not expect to see the same man who went away. He will be grown up—developed. He has been handling men, living intimately with death and destruction, and thinking about it, and he will bring back knowledge that can't be gained in any other way. His primary concern when he gets home will be to land a job.

He'll have some gripes, of course. He'll wonder how it was that So-and-So could stay home and make money while he was being shelled and bombed. He'll wonder how it was that there could be strikes while he was fighting, and he'll feel lost at being by himself again, away from the lads he shared so many dangers with. He's homesick for home now; he'll be homesick for his outfit then. We must get ready for him because he deserves all we can do for him.

The farsighted plans and policy of the Army Ordnance Association will be an important contribution to our future security. The continuance of research and development will protect us from surprises, and your plans for their prompt application to production will insure timely supply in case of need. You know better than I do the importance of such preparations, and every American who is concerned about our future defense will applaud your efforts.

General Stilwell is Commanding General of the U. S. Army Ground Forces. He was formerly the commander of the China-Burma-India Theater.

This is an address delivered before a meeting of the Cleveland Committee of the Army Ordnance Association, Cleveland, Ohio.

The Case for Military Training

Our Plans for National Postwar Preparedness

Hon. James W. Wadsworth

I SERVED in the Senate during World War I and those years immediately following, having been retired, by the will of the people of the State of New York, in 1927 to my home. I shall never forget some of the things that happened when I was chairman of the Committee on Military Affairs. Many will remember the tremendous interest that our committee took in the Army as a whole and especially in Ordnance work, and the confidence which our committee held in the then Chief of Ordnance, Maj. Gen. C. C. Williams. We also can recall the tremendous help that was given to us then and has been given to many committees since by the Army Ordnance Association, headed by the former Assistant Secretary of War, Benedict Crowell. I wish their warnings had been more influential in those days.

We had just finished a war to end all wars—a very large portion of the people believed that that had been accomplished. We had made the world safe for democracy; there was no doubt about it. The people of the United States turned their attention to immediate domestic problems with a result that they insisted, as I recollect, that Congress, as representatives of the people, pay just as little attention as possible to the matter of military preparedness.

In fact, they insisted the way to achieve peace or to maintain it when it was achieved was to disarm. To our horror, the Regular Army was reduced to about 118,000 men by 1923; the National Guard was reduced to about 160,000 men—and not a single unit in either of those components was at anything like war strength. We sank a third of our Navy. We entered into various agreements for the limitation of armaments and, among other things, an agreement with Japan not to fortify the Philippines further, receiving in return her agreement that she would not fortify the Marianas or the Carolines when she took the mandates over those islands!

We are paying the penalty today. We have been paying it for some years now. My hope is that we have learned a lesson; yet there are still people to be convinced. In 1920 we amended very comprehensively the National Defense Act of 1916. In fact, we in effect redrafted it, and I think we accomplished some good things. We established the principle that there should be one Army of the United States, and we effected many improvements in the interior organization and processes. In a word, we erected what might be termed a skeleton structure rather soundly designed. Then we failed to fill the structure with men.

LET me remind you of an incident in that connection. The Senate Committee on Military Affairs by an overwhelming vote in 1920 inserted in the proposed bill for the amendment of the National Defense Act a provision for universal military training. They stated that the training should last for four months and that every young man upon reaching a certain age should take it. When it became known that the committee was to propose that to the Senate of the United States we were then waited upon by the political leaders of both parties and warned that if we dared to propose such a thing to the Senate or the House of Representatives it would be torn to pieces and kicked into the wastebasket. It would become a political issue. The parties would rival one with the other as to which would make the most out of it politically, with the result that it was overruled. In my mind it was a terrible error. Had we planted the seed at that time for a sound military policy, which we have never had in this country in time of peace, the story today might be very different.

In any event we failed to fill the structure with men and continued to rely in time of peace on the volunteer system for recruiting our armed forces. Fortunately, the Selective Service Act of 1940 was passed fourteen months or thereabouts before Pearl Harbor. With the passage of that act and accompanying appropriations in the summer of 1940, the War Department had a fairly decent chance to begin to get ready. It had an opportunity to build some foundations upon which a great citizen Army could be erected.

> **"My plea is that America shall be strong in righteousness, and the way to be strong is to let the world know that under our democratic system of government every American understands the obligation to defend our free institutions and is trained to do so."**

The House of Representatives has created a committee known as the Special Committee on Postwar Military Policy. It is headed by Congressman Woodrum of Virginia, a very able man, and is composed of seven members from the House Military Affairs Committee, seven members from the House Naval Affairs Committee, and nine members from the House at large.

There are some very interesting items on the committee's agenda. For example, there is the matter of scientific research and development in which, of course, the Ordnance Department is enormously interested. We have had exceedingly informing witnesses from Ordnance in the Army and in the Navy and from civilian scientists who have worked together during this war. The Government mobilized overnight, as it were, the best scientific minds in the civilian world to assist the military services in the design of new weapons.

We are going to propose, and I think this is no violation of military secrecy, that the scientific research and development organization shall be made permanent, so that there shall be a partnership under a statute, for the first time in our history, between the civilian and the military scientists. There is no political issue involved, and there is no disagreement about it amongst the scientific people, either in the military service or

Mr. Wadsworth is United States Representative from the 41st Congressional District, New York. He is a member of the House Military Affairs Committee, the father of the National Defense Act of 1920—our charter of industrial preparedness—and a national director of the Army Ordnance Association. This is an address delivered at the first meeting of the Aberdeen Proving Ground Post of the Association, Aberdeen, Md.

in the civilian field. I look forward with a good deal of optimism to the enactment of legislation of that kind which, if properly administered in years to come, long after this war is over, will go far toward keeping our military services abreast of modern scientific research and development.

With regard to universal military training, we stand first on the principle that in a democracy such as ours where every citizen is entitled, under the Constitution of the United States, to equal opportunity, there goes the equal obligation to defend against attack the institutions which, if they survive, guarantee him the possession of the privileges of a free citizen. In other words, there is a duty to the country for every able-bodied man to undergo training so that he will be prepared to defend his country. That, I think, is a democratic principle, the soundness of which cannot be denied. It is proposed that there should be no distinction whatsoever between young men no matter what their antecedents, their national origins, their racial characteristics, or their religious beliefs—all shall serve through the training period together.

I have been convinced during all these twenty-five years that such a contact between young men from all the homes in the United States will do more to strengthen our democratic spirit than any other one thing we could do. It would help young men to understand one another, to sympathize with the difficulties that one group experiences as contrasted with another group, and they will go home after that training better prepared as citizens to defend our institutions in the political field. It is proposed that this shall be done and that this training shall take place when the men reach the age of eighteen.

IN the discussions which we have had upon this subject, some doubts have been expressed by persons rather prominent in the educational field who seem to feel that it would be a calamity to interrupt in any respect the plans of a young man to go through college. There is a sharp difference of opinion on that. I shall not enlarge upon it, but in order to make the system as elastic as possible and to interfere as little as possible with the youngster's plans, we propose that upon reaching the age of eighteen he may select any one of the succeeding four years in which to take his training; but he must take it eventually. Furthermore, to add another element of elasticity, if upon passing his seventeenth birthday he was graduated from high school, then he may immediately apply to commence his one year of training.

It will not suffice to train 900,000 men a year (about 250,000 for the Navy and Marine Corps and about 650,000 for the Army and Air Corps) unless at the same time adequate provision is made for obtaining officer personnel. Without competent officers, every military undertaking falls flat. We propose that the citizen officer personnel, which will always be something like ninety per cent of the commissioned officers in the armed services, shall be secured with the help of the colleges in the R.O.T.C. program.

PASS IT ALONG

►**Because of the Government's wartime restrictions on paper consumption, not enough copies of ARMY ORDNANCE can be printed to meet the rapidly increasing demand. You will be doing a favor to industrial preparedness if you will pass your copy along to some friend of the Industry-Ordnance team.**

We have proposed that the officer-candidate school system be maintained so far as is necessary because there will be quite a number of young men coming out of training camps who for some reason can't go to college. They must not be denied the right nor the opportunity to become officers. To meet their difficulties, it is proposed that the War and Navy Departments maintain officer-candidate schools to give these men a chance. In a word, the proposal means that every young man who is ambitious to advance and who is interested in the job will get his chance under a democratic system.

A difficult problem comes up in this respect. What are we going to do with the men as they graduate from the training camps? How are they to be organized into units, the country over, if at all? Some of the supporters of this legislation are so anxious that the principle of universal military training be translated into law that they hesitate to go further and decide by legislation what should be done with the 900,000 young men who may be graduated every year. One proposal is that they simply become members of a huge pool of individually trained soldiers and sailors.

I AM hoping that we can go as far as possible toward the objective of having trained units in being. I believe it will be difficult to throw together a regiment or a battalion of infantry after war starts, even though there is a sufficient number of officers and enlisted men to man it, if the officers have never seen the enlisted men and the enlisted men have never seen the officers and if they have never acted together as a unit.

We have no desire to impose our will on other peoples and make them accept a form of government which we think they should have. What we want to do is to lead the world in the paths of decency. The word decency is the only one I can summon that will describe what I have in mind and which I know the American people have in mind. But it isn't enough to have a motto, "Let us have peace," unless we have strength to support our ideals. If you trust solely to solemn documents and contracts signed by the leaders of the nations—great and small—and are not at the same time strong in the interests of righteousness, some day an aggressor, despising your ideals and recognizing your weaknesses, will slap you in the face.

That has happened to us twice—in 1917 and in 1941. We were decent, we begged for peace, we disarmed, we tried to persuade others to disarm, but the aggressor paid no attention to our ideals, and we are paying the penalty. My plea is that America shall be strong in righteousness, and the way to be strong is to let the world know that under our democratic system of government every American understands the obligation to defend our free institutions and is trained to do so.

The first man to recommend universal military training to the people of the United States was George Washington. He recommended it in his message to Congress in 1790. How different our history might have been had his advice been taken! Washington was right, and I hope that we will remember what he said and why he said it, that we will look this world over as realists and idealists, and, finally, for the first time since Washington was President, adopt a sound military policy for the United States.

It Teaches Officers and Men Every Armament Specialty

Col. W. R. Slaughter

This is the first in a series of six articles being written for ARMY ORDNANCE on that great training establishment, the Ordnance School, Aberdeen Proving Ground, Md. This initial article deals with the development and the rapid growth of the school and describes how its alumni, commissioned and enlisted Ordnancemen, are applying their knowledge on the battle fronts in all theaters of operations.

ANY school that graduates 18,851 students in the course of one year is an institution to be ranked among the Nation's largest. The Ordnance School did just that during 1944, and it proudly believes it is fulfilling its wartime mission of imparting the largest possible amount of knowledge to the greatest number in the shortest possible time.

The Ordnance School is an institution for teaching the soldiers of the Ordnance Department the technical and practical aspects of their work. It prides itself less on its size than on its versatility, its thoroughness, its progressiveness, and its immeasurable effect upon the course of the war. It has overcome innumerable knotty problems in streamlining its instruction to fit the needs of modern, high-speed war, but it has not compromised quality for acceleration. Instead, it has emerged as a leader among technical institutions—both civilian and military—as attested by the widespread interest in its techniques by all types of educators and craftsmen.

It is a far-flung establishment both in its facilities and equipment and in its influence. Its headquarters and principal home are just across the way from the Research and Development Center at Aberdeen Proving Ground, Md., but it has, or has had, sections and affiliates at a variety of other places. It has operated at Detroit, Flint, Lansing, and Pontiac, Mich.; at Akron, Toledo, and Cleveland, Ohio; Springfield, Mass.; Savanna, Ill.; Atlanta, Ga.; Bloomington, Ind.; and other localities—all at the same time.

The schools at Detroit and other cities were located in factories where ordnance matériel was being produced industrially. This was an added advantage as it gave the students an opportunity to observe the actual manufacture and test on the proving grounds of guns and tanks which they would some day be called upon to repair and return to battle. The school at Aberdeen now utilizes more than 300 buildings and covers an area of roughly 276 acres, exclusive of leased tracts for field-training purposes.

Like so many of the specialized training establishments of the U. S. Army, the Ordnance School is largely an outgrowth of the present war. Due to the sudden and large demands for its graduates, it had a mushroom growth following a small and labored beginning. Since 1901 various schools have existed within the Ordnance Department for the instruction of officers and enlisted men, but the present school did not come into being until the summer of 1940.

Before that, there had been an Ordnance school of application at the old Sandy Hook Proving Ground, N. J.; an Ordnance school of technology at Watertown Arsenal, Mass.; an Ordnance operations, maintenance, and repair school at Raritan Arsenal, N. J.; and various courses sponsored by the Ordnance Department at the Massachusetts Institute of Technology, Cambridge, Mass., and at Aberdeen Proving Ground. From time to time there had also been numerous technical schools conducted with the coöperation of various manufacturing plants throughout the country.

TO give some idea of its growth, in 1940 the Ordnance School had a commandant, assistant commandant, three commissioned instructors, and one enlisted instructor for its entire staff. Their whole concern was the training of officers. At this time the Ordnance Field Service school at Raritan Arsenal, which later became the enlisted section of the Ordnance School, was also operating, but under severe limitations. The two schools were consolidated in 1940.

Before the present permanent buildings were completed it was necessary to use the museum at the Aberdeen Proving Ground for instructional pur-

Colonel Slaughter is commandant of the Ordnance School, Aberdeen Proving Ground, Md.

poses. As a matter of fact, when the school started classes the following July, the shortage of instructional equipment was so acute that it was necessary to distribute the museum specimens so the various sections could have classroom demonstrations.

The school's growing pains are matters for the historians. Now it is going full blast. Late in 1944 its total operating staff and student body, both at Aberdeen and elsewhere, numbered over 7,000 persons. Its job is to train both officers and enlisted men in every Ordnance technical specialty as well as to provide the military and technical training of Ordnance officer candidates. Due to the limited time available, it has inclined toward more and more specialization in its instruction—always adjusting its curriculum to meet battlefield requirements.

Enlisted men, formerly given 9-month courses in broad fields such as automotive repair, instrument repair, ammunition supply, and the like, are now given 2-month courses in one limited phase of some particular field. For example, instead of the single automotive course, specialized instruction is provided for automotive electricians, carburetor and fuel-induction mechanics, wheel-vehicle engine specialists, track-vehicle engine mechanics, chassis experts, and tractor mechanics.

Aviation Ordnance students study a bomb shackle device at the Ordnance School.

Similarly, the Ordnance Officer Candidate School, which was activated and made a part of the Ordnance School in July 1941, has constantly modified and improved its course to meet theater of operations needs and already has graduated over 12,500 officers. In much the same manner have the officer courses undergone change and expansion as field experience has shown the need for increased technical and military training for our commissioned leaders and staff officers.

Indicative of the scope of training given at the Ordnance School is the fact that a total of 52 different subjects were taught during the final quarter of 1944 in 147 separate classes, in addition to the officer-candidate course with 4 classes at a time and the base shop with 22 courses.

BRIG. GEN. D. N. HAUSEMAN, director of the Readjustment Division, Army Service Forces, was quoted in the *Army-Navy Journal* of December 30, 1944, as saying that "we are not now using a single weapon in the same form or design as before Pearl Harbor." This statement accounts for the twists and turns and somersaults that Ordnance training has had to go through to keep its students abreast of current developments. It indicates at a glance the evolution that has marked the courses at the school. Instruction rarely has a chance to become routine before obsoletion or modification of matériel dictates a change. New courses and new training aids must be developed constantly and quickly.

When the amphibious "Weasel," officially known as the Cargo Carrier M29C, was first being produced, a course was initiated to instruct Army and Marine Ordnancemen in its maintenance so that repair crews would be available at the time the new vehicle was first issued to the using troops. Similarly, special units have recently been trained to man the new Ordnance floating maintenance barges which will perform maintenance for units engaged in Pacific island warfare. Usually the course changes are not as abrupt or complete as in these cases, but such high-priority assignments illustrate the versatility that must and does characterize the school.

To compute the effect of the training at the Ordnance School on the course of the war involves a number of unknowns. The number of graduates, the length of each course, the subsequent assignment of each student, and a host of other facts are available. How each person profited by his training and with how many others he shared his newly gained knowledge are the factors that can only be estimated. Advanced specialized training is predicated on the theory that these two factors will be utilized to the fullest, and, judging from the reports from all over the globe, they have.

Enlisted Ordnancemen soon learn to become experienced arms machinists in the well-equipped shops at Aberdeen.

Over 60,000 officers and men have graduated from the school, and practically every Ordnance unit and organization has representatives within its ranks. The influence of the school is much more far-reaching than the figures indicate, however, because a high percentage of the graduates are used as instructors upon return to their organizations. Reports have proved that the training one man receives is transmitted to others in his unit, and that the student, his fellow soldiers, and his organization all profit from the advanced training given to the one man that attended the school.

LET us take a look at the hypothetical case of the sergeant who left the Ordnance School and rejoined his outfit before it embarked for Europe. He was a welder, and, after a couple of months at Aberdeen, he could handle any job

that called for a torch and rod. Figures alone tell you that he is just one of thousands graduated from the Aberdeen classes in 1944. But *is* he just one man on that roster?

Actually, the sergeant had come to Aberdeen to do more than learn how to weld. There were a half-dozen welders in his outfit, all about as good as he. The commanding officer undoubtedly picked him to attend the course because he thought he would make a good teacher. Success or failure of the organization in the performance of its mission depends largely upon the selection of appropriate individuals for advanced training. Fortunately the sergeant *did* make a good teacher. Shortly after he came back you could find little groups around him in the shop almost anytime. The sergeant was passing on what he had learned until there no longer was any "best" welder in the outfit. All could claim some benefit from the sergeant's having attended school.

The school has had a more comprehensive hand in the training of officers. In the course of the Ordnance Department's vast expansion, a majority of its officers have been processed by the Ordnance School, either in its officer-candidate course, its officer-training program, or in the conference courses given at "troop schools" at dozens of Ordnance installations where Reserve officers and men with direct commissions had been assigned to duty.

The theory behind officer training differs from that of enlisted schooling in several respects, hence there is considerable dissimilarity in the schooling given each. First and foremost, officers are leaders; enlisted men are technicians. Officers must be indoctrinated with the means of fulfilling their responsibility for the individual and collective welfare of their men; enlisted personnel look to their officers for this care and leadership. Officers must be versatile to handle the myriad duties to which they might be assigned; enlisted men must be specialists in a particular field.

The officer-candidate course has been adjusted time and again to meet the needs of the theaters of operations. Training has been streamlined and expanded at the same time. During the three years since its inception, the course has passed through three distinct phases—a slow and experimental beginning; a period of high speed and overcrowding; and, finally, a period of slackening of load and refinement. At one point it was possible only to select leaders from among the candidates and to teach them the rudiments of military administration, supply, and maintenance, together with a rapid familiarization course in some one Ordnance specialty.

Later, as the urgency for officers decreased and field needs were better understood, the course was lengthened to provide additional technical instruction and field exercises where the lessons learned could be applied. Its present stage of evolution is a basic course of four months' duration, after which the graduates take two months of technical training as officers. This plan has paid off well, since junior officers are now able to be technical leaders and advisers, as well as troop commanders.

IT is one thing to put young officers through primary training but quite another to indoctrinate field-hardened officers in the job of staff planning. Officer training is the least understood of the three types of instruction handled at Aberdeen, for it represents taking qualified personnel and orienting them in Army ways, teaching them a useful Ordnance specialty, and training them to be staff officers, troop commanders, observers, inspectors, or technical administrators. Some of the officers were commissioned without any prior military training. Others had long-standing commissions and needed schooling in the "new" Army. Many received direct commissions because of a useful civilian specialty. Still others had previously been schooled, but returned for further training so they could assume greater responsibilities.

These divers backgrounds necessitated many different types of instruction, so the Ordnance School sponsored training programs to make every man a useful cog in the great Ordnance machine. Many a man who thought he had taken his last examination when he got his A.B. "hit the books" in preparation for unforeseeable responsibilities. The efficiency and prestige of the Ordnance sections of the staffs of many corps, armies, and theaters of operations are testimony to the thoroughness of the school's officer training.

But these represent only one manifestation of the training service of the Ordnance School. Classroom teaching and practical work under field conditions have not been the whole story. Originally it was supposed to be, but the staff at Aberdeen kept finding additional training needs—and the best ways to meet them. Training being an endless process, it was recognized that troops need more and more instruction right up till the time they match wits with the enemy.

So technicians and instructors were sent from Aberdeen to spots all over the globe, where they have carried on the mission of the school. Men have been furnished as training teams. Courses for other training installations have been designed. Publications carrying the Ordnance School credit line, including textbooks, and the monthly magazine *The Ordnance Sergeant,* have been sent to troops on every fighting front. These filled the gap when there were no other books to be had and acted in the rôle of "extension courses" for the benefit of men who had no opportunity to get formal classroom training. Ordnance film strips, multicolored charts, training films, and, most recently of all, plastic models, have been developed to assist in instruction not only at the school but also at any place where men are undergoing training in the use or maintenance of ordnance.

Secretary of the Navy James Forrestal recently stated: "The weapons of modern warfare can be operated only by trained men. A novice is helpless and vulnerable." A corollary might be added to that thought, since it has been proved time and again that maintenance and supply troops need specialized training in order to operate at peak effectiveness. The application of old-fashioned, slow methods of moving supplies to the front and of keeping them in shape would constitute a serious hazard to the progress of any field army.

The reports which have been received from the various theaters of operations indicate that the commanders are more than satisfied with Ordnance service. It is gratifying, indeed, to realize that the Ordnance School, through its officer and enlisted graduates, is contributing to the success of our armies in the field.

How Our Ordnance Concrete-Piercing Fuze Cracked the Siegfried Line

Col. George G. Eddy

Ordnance's new science of "terminal ballistics" was ready to solve the problem of penetrating the steel and concrete fortifications of the Germans and the Japanese when the need arose. Exact duplicates of enemy pillboxes were built at Aberdeen Proving Ground, Md. Our high-explosives scarred the concrete but did not penetrate; our armor-piercing rounds penetrated but did not destroy. What was needed was a high-explosive shell that would also penetrate. The concrete-piercing fuze solved the problem as related here.

THE concrete fortifications of Poland, Belgium, and France were outflanked so completely during the German *Blitz* of 1939-1940 that many experts overlooked the significant part that concrete fortifications were later destined to play. Throughout the North African campaign, there was slight mention of concrete field fortifications. Since then, however, allied armies in Italy, France, and Germany, and to a lesser degree in the Pacific, have been confronted with a series of massive concrete fortifications. They have faced the vaunted Gothic Line, the much-publicized Atlantic Wall, and the "impregnable" Siegfried Line. Japanese "carbon copies" of these defenses in the South Pacific have been a worrisome thorn to the American advance.

The Germans took advantage of every opportunity to propagandize the invulnerability of these fortifications. They exploited the fear psychology usually present whenever a gigantic military maneuver like an invasion is undertaken. Through constant repetition of the invulnerability theme, they sought to undermine allied morale and to discourage invasion. The tragedy of the Dieppe raid lent some credence to their claims. Where the Germans failed, though, was in underestimating our thoroughness in planning for the attack.

Before Pearl Harbor, research in ballistics was divided into two principal categories: interior and exterior ballistics. Exterior ballistics covered all phases from the moment the projectile left the gun until it arrived at the target. At the beginning of the war, it was realized that the ballistics involved when the projectile arrived near the target were of such magnitude that it was advisable to separate this phase of exterior ballistics into a category of its own called "terminal ballistics." The organization and instrumentation were, therefore, already available to undertake the problem of concrete without loss of time.

MORE than three years ago, American intelligence reported that the Germans were building an improved type of concrete pillbox. It was more heavily reënforced; its walls were thicker. It was to be invulnerable to ordinary artillery fire. Light artillery could not reduce it. Heavy artillery could pound it unsuccessfully for hours. It was to become a part of an impregnable German inner wall--the Siegfried Line.

Intelligence agents in Europe sent exact specifications of various types of German pillboxes. Army Service Forces' engineers built replicas at Aberdeen Proving Ground which were even stronger than the originals. The compressure strength varied from 5,000 to 7,000 pounds per square inch. Dirt was then piled along the sides and over the tops of the models.

Meanwhile, considerable technical data had already been collected on the terminal ballistics of ammunition to form a basis for a preliminary analysis of the situation. The Industry-Ordnance team had provided a complete range

Colonel Eddy is director of the Research Center, Aberdeen Proving Ground, Md.

Signal Corps

A German Panther tank disabled beside a bunker of the Siegfried Line.

of artillery pieces from the 950-pound 37-mm. gun to the hard-hitting 30-ton guns and howitzers. All effort was now concentrated on the task of analyzing the effect of our ammunition.

TWO types of ammunition were tested: high-explosive shell with standard delay fuzes and armor-piercing shot. The high-explosive shells were not satisfactory when used against three to ten feet of concrete. The armor-piercing shot would penetrate effectively but would not reduce the pillbox to rubble. Although an armor-piercing shot might enter a pillbox and temporarily knock it out, it still remained a barrier to tanks, and stubborn defenders could infiltrate at night and reoccupy the position. In short, armor-piercing shot was good—but not good enough for the job at hand.

Actually the Ordnance Department furnishes two types of armor-piercing ammunition for mobile artillery weapons. These two types are armor-piercing shot for high-velocity weapons and high-explosive antitank ammunition for low-velocity weapons. It was apparent, therefore, that favorable results could be obtained with American guns but that we were unbalanced when the howitzers were considered. This meant that we were not exploiting the full capabilities of the howitzer line. Here was a serious handicap, since the basic artillery piece of the American Army is the 105-mm. howitzer. Also, the powerful larger-caliber howitzers—some of the Army's most accurate weapons—could not be used effectively against concrete fortifications. All howitzers had to be provided with an excellent anticoncrete round.

At this point, a study of the probability of hitting a very small well-camouflaged target at various ranges was completed. This showed that at the longer ranges, using indirect fire, an excessive number of rounds had to be fired to obtain the number of hits required for destruction. In addition, it required too much time to reduce an area. It was further evident that the target would be so obscured that observation of hits would be almost impossible. Economy of supply, coupled with the necessity for certainty of results, indicated that direct fire should be employed whenever possible. This led to the inescapable conclusion that the time required to reduce a pillbox five to seven feet thick should not exceed a few minutes.

The data developed on the behavior of concrete clearly indicated the required characteristics of the projectile, a few of which may be disclosed. It should be provided with a delay fuze and the length of delay is important. It has to remain intact in order to achieve satisfactory functioning after perforation or maximum penetration. It should be of high-capacity explosive content to obtain shatter effect, to cut and remove reënforcing, and to remove the greatest possible volume of concrete. Shatter effect is cumulative and materially increases the effectiveness of each succeeding hit. This requirement is of extreme importance when the thickness of concrete exceeds the capability of the caliber to perforate completely on the first hit. Removing reënforcing is a necessity in order that men, vehicles, combat cars, and tanks may pass through if necessary.

The time factor was of great importance. To design, develop, manufacture, and issue a complete new anti-concrete round of ammunition for each caliber from 75-mm. to 240-mm. howitzers would not only take too long but would also throw an additional heavy burden on industry at a time when we could ill afford it. Actually, it was felt that we had an ample number of different types of ammunition without adding further to the burdens of industry and a heavily taxed supply system. The theaters of war were already heavily stocked with standard ammunition. The obvious answer which kept recurring was to improve the effectiveness of standard ammunition.

SHELL, fuze, and booster drawings were examined and studied. Many sketches were produced, and finally inert-loaded projectiles with inert fuzes and boosters were fired against heavy concrete structures. The results were studied to find out how the fuze,

Ordnance officers check effect of an M78-fuzed shell on a pillbox at Aberdeen.

booster, and shell body withstood the impact. The answer was soon apparent: the standard high-explosive shells could be used if a path could be broken for them as they penetrated the concrete.

If only a fuze could be designed that would achieve the desired results! Such a fuze would not only solve the anticoncrete shell production problem but would also make every standard high-explosive shell a superior anticoncrete one. Of all the fuzes in our standard line of contour fuzes, there was not one that provided a satisfactory solution.

Upon the completion of a thorough analysis of all data developed up to this time, the basic design features were established, and a suitable material was selected for the fuze (security precludes a discussion of design features). There followed many strenuous days and nights, during which a cycle of analysis, design, manufacture, and test was repeated at Aberdeen until the M78 fuze was finally perfected.

On a bitter cold day in January, the first tests were made. Biting winds and flurries of snow swept up the winter-dulled Chesapeake Bay and across the Gunpowder River to the field where silent pillboxes lay in sinister rows. Shells whined into the dark concrete. Huge, gray dust clouds obscured the pillboxes from the observers. Large and small guns roared and reëchoed across the river at the so-called impregnable walls. When the smoke had cleared, concrete walls as thick as a man is tall had crumbled to dust. The impregnable wall was no longer impregnable. A little concrete-piercing fuze, no larger than the palm of a man's hand, proved to be the David that could knock out a Goliath!

THE development was a success—an anticoncrete fuze which can turn an ordinary shell into a missile capable of blasting its way through concrete thicker than twice the height of an ordinary man in less time than it takes to tell about it; a fuze that fits all caliber shells from the 75-mm. to the 240-mm.; a fuze that makes it possible for the smaller calibers to blast through five to seven feet of reënforced concrete in a matter of minutes while the larger calibers will go through with one to three hits. After many conferences with personnel of the Office of the Chief of Ordnance, particularly with Maj. Gen. G. M. Barnes, chief, Ordnance Research and Development Service, a few minor changes were made, and the fuze was ready for production.

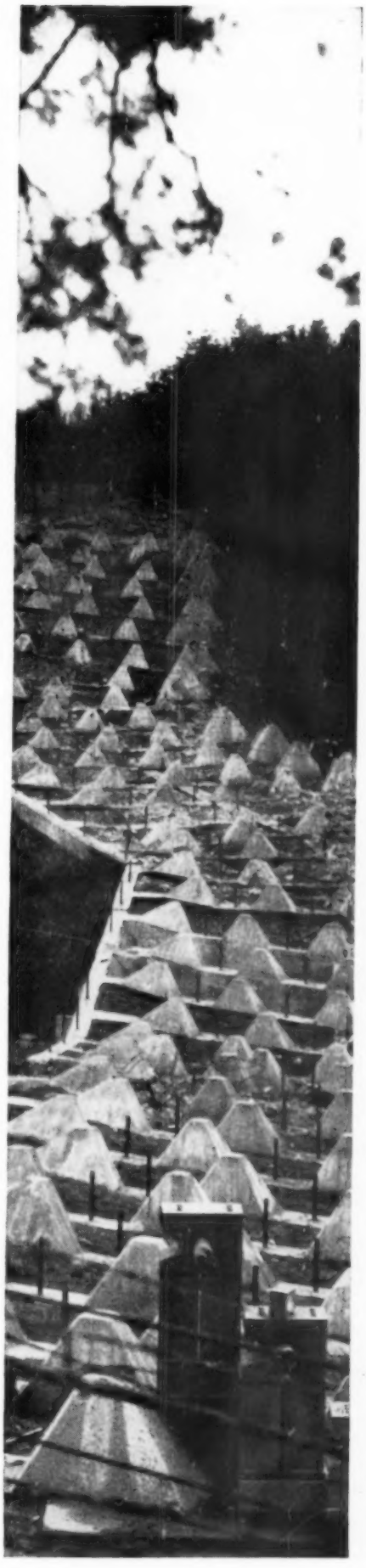
AT a demonstration held near Oran, North Africa, in early February 1944, it was my privilege to introduce this fuze to Field Marshal Sir Henry Maitland Wilson, then Commanding General, Mediterranean Theater of Operations, and Lieut. Gen. Jacob Devers, Commanding General, North African Theater of Operations. Later that month, when I was near Cassino, General Devers sent for me. I reported to him that evening at the King's Palace in Caserta. As a result of that conference, an initial supply of M78 fuzes was flown to Naples and immediately used against the German fortifications at Cassino.

Since its introduction to battle at Cassino, the M78 concrete-piercing fuze has been made available to all the theaters of operations. It has provided our armies with a ready means of quickly disposing of the so-called impregnable concrete pillboxes and fortifications of the enemy.

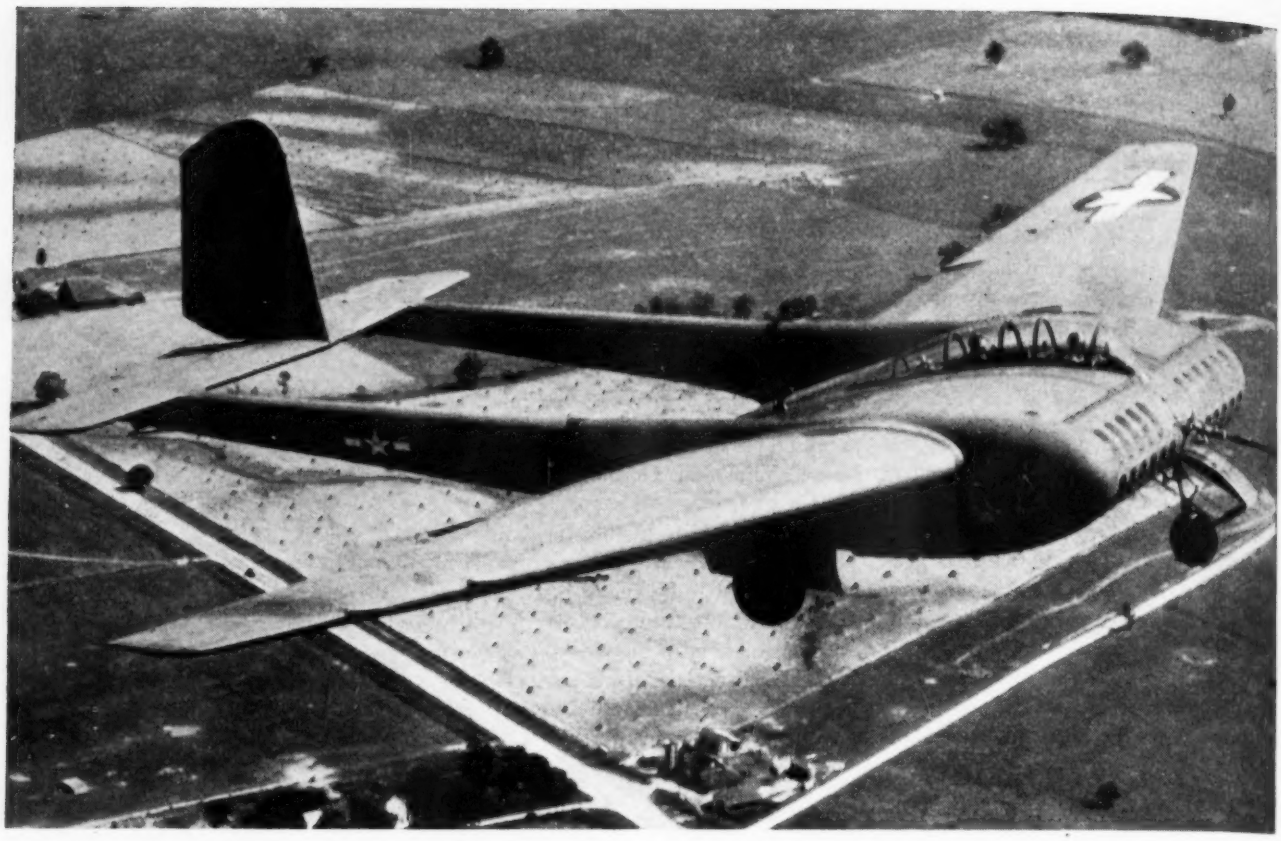
The American armies in the theaters of war have used this fuze with phenomenal success. Many instances have come to the attention of the writer where the use of this fuze has enabled our artillery to reduce centers of resistance in record time with a minimum expenditure of ammunition. The enemy now knows that he is not safe behind his walls of concrete. He knows that he no longer possesses impregnable fortifications.

The development of the M78 concrete-piercing fuze is an outstanding example of the dividends that are made possible by the Ordnance Department's policy of continuing to subject ordnance items to technical analysis after they have been standardized and issued to troops. The Department is vitally interested in increasing the combat efficiency of all standard items of ordnance equipment. Such a policy goes a long way toward eliminating demands for gadgets for single-purpose use. Above all, it increases the flexibility of our equipment and reduces the number of items that must be designed, manufactured, stored, and maintained.

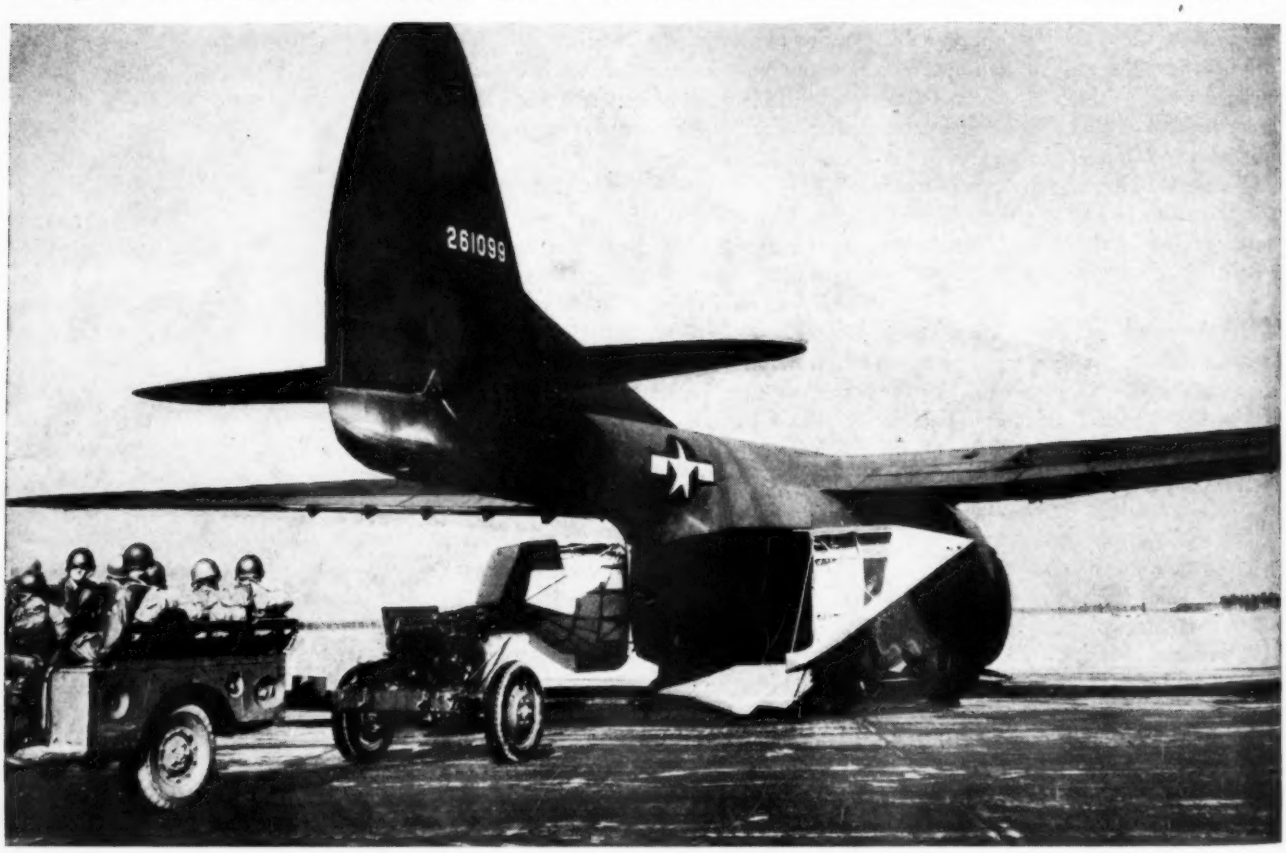
The development of the M78 fuze to meet an urgent combat requirement has demonstrated again that the Ordnance Department can lick any ordnance problem that our enemies can produce—secret or otherwise.



New Gliders for the Army



The CG-16 cargo glider, above, is a twin-boom craft utilizing an airfoil section as a fuselage. It can carry a large pay load for the size of its cargo space. The CG-10, below, is the First Troop Carrier Command's newest and largest glider, known as the "Trojan Horse." It is shown here disgorging 9 men, a weapons carrier, and a 105-mm. howitzer from its interior (AAF photos).



Across the Beachheads

Ordnance with the Third Army in Three Invasions

Col. T. H. Nixon

PEARL HARBOR was less than eight months' past history, our grievous losses in the Philippines were fresh in every one's mind; and Rommel had become master of Tunisia and Libya and was threatening Egypt when our War Department's plans for positive and aggressive action against the Axis were being brought into shape.

During the latter part of July 1942, a small group of staff officers assembled in Washington to plan an attack somewhere in Morocco or Algeria. The mission given to Lieut. Gen. (then Maj. Gen.) George S. Patton, Jr., was the planning of a decisive invasion to be made either just inside the gateway to the Mediterranean or along the Atlantic coastline of North Africa. At the same time, he was told the approximate number of divisions that would be available for the operation. The following steps were taken in making the Ordnance plan.

In the first weeks of the planning phase, throughout which we all worked secretly in Washington, an estimate had to be made of the Ordnance troops required to support the operation, including troops not only for the Ordnance Field Service in the task force, but also for the services of supply installations which were to follow up the invasion. The next step was to equip the specific units of all types, both combat and service, which had been designated for the operation. In view of the various types of Ordnance equipment which were in the hands of troops under training at that time throughout the United States, it was decided to standardize on a single model of each type weapon or vehicle or other Ordnance item in equipping the Western Task Force, in so far as was possible. For example, medium tanks were to be those powered with the Wright air-cooled radial motor, while all light tanks were to be those using the Cadillac motor.

In equipping the Western Task Force, decisions had to be made relative to the introduction of certain new and special items of ordnance, such as the bazooka, which was used for the first time in the North African invasion. Also, the technique of waterproofing for beach-landing operations, developed at the Holabird Ordnance Depot and the Aberdeen Proving Ground, Md., was to be tried out for the first time on a large scale in actual operations where failure could mean loss of life or serious hindrance to the success of the enterprise. Many of these new technical developments were not firmly crystallized at this time, but, under field tests which led to some modifications and improvements, they were brought to a higher state of perfection.

The soldier handling ammunition, possibly under bombardment; the depot soldier hauling, sorting, and issuing supplies, suffering casualties and seeing his buddies killed and wounded; the bomb-disposal expert who disarms live bombs that others may live—these are the men who have contributed so much to our success in battle, for modern warfare is, as much as anything else, a war of maintenance and supply.

In planning the operation it was assumed that we would have to overcome continuous enemy resistance all the way from our coastal sector, between Safi and Port Lyautey, to the Taza Gap in order to meet with our Central Task Force. Considerable ammunition was to be carried by the invasion armada. In the planning stage, we made the mistake of attempting to earmark each individual case of ammunition for the organization to which it would be issued, the ship on which it was to be loaded, and precisely where in the vessel it was to be carried—on deck, in vehicles, or in the hold. At the last minute, as we should have foreseen, after ammunition trains had arrived at the port and loading was to begin, it became necessary—due to other important factors—to change the priority of loading for various subtask forces. So far as we were concerned with our ammunition, the resulting chaos was indescribable and was solved only by shipping additional ammunition to the port from interior depots.

Once again we had learned the importance of maintaining the utmost flexibility in a plan which necessarily involved the coördination of diverse and complex elements. In this instance we learned not to earmark ammunition so closely but simply to have it available in the proper over-all assortment and quantities at the right time and place where using units could draw it.

During the final staging of troops for embarkation, very little opportunity was afforded for special training. It was possible to make some Ordnance inspections with resulting benefits to the using troops. The main Ordnance problem throughout was initially to equip all units, then to provide for reasonable quantities of spare parts to be carried by accompanying Ordnance troops, and finally to plan for the replacement of cyclic parts as needed. For example, certain tracks could be expected to last for 1,500 miles, after which they would have to be replaced. It was necessary to arrange by careful advance planning for the shipping of replacement tracks in closely estimated quantities so that they would arrive at the overseas target at about the time they would be needed. This kind of planning had to be done for thousands of separate items, each of which presented a different problem.

IT was realized that Ordnance personnel would have to be landed early in the operation. Ammunition companies were placed high on the landing priority list. It was found that while the personnel of maintenance units could be moved early, it was not possible to move all of their tools and equipment until succeeding convoys. Accordingly, Ordnance mechanics were instructed to carry their hand tools as well as their weapons, in order that they might move earlier. Similarly, designated men of maintenance units carried small kits of spare parts. After

Colonel Nixon is Ordnance Officer of the U. S. Third Army.

arrival in Morocco, certain errors in the plan were brought to light. Unnecessarily large amounts of certain types of ammunition had been carried. Kits of spare parts were short of some items which became critical due to climate and terrain. Many useful lessons were learned in this operation which have served us well in later campaigns.

After the early cessation of hostilities in Morocco, one of the first things done by Ordnance was to acquire locally as much automotive equipment as could be found in usable condition, or in condition that could be made serviceable with available parts. This was accomplished by the Task Force Ordnance Section which took over the largest automotive installations in Casablanca. At the beginning they were taken over completely, together with all equipment, spare parts, and personnel. As military personnel became available, many of the civilians were released to their former employers. In the same way, usable tools, equipment, and spare parts were selected and paid for while the remainder reverted to the owner's use. Also, a number of the buildings were found suitable for Ordnance supply depots and maintenance shops.

An ammunition depot was initially set up midway between Fedala and Casablanca, to which ammunition moved by truck and rail from Safi and points south. A much larger depot was soon established in the Forêt de Marmora, north of Port Lyautey, in which a stock of approximately 70,000 tons was held. Civilians were used extensively to augment the ammunition companies.

A LARGE depot for other classes of Ordnance supplies was located in Port Lyautey, having the advantages of good harbor facilities and being on the main railway route to Algiers. Subsequently, much of the Ordnance supplies and equipment from this depot was used to alleviate shortages of the Central Task Force and are believed to have been a contribution of some importance to the success of the campaign which later developed in Tunisia.

In the latter part of February 1943, while General Patton was away commanding the II Corps in Tunisia, we received instructions at task force headquarters to start making plans for the Sicilian operation. The problem this time differed from our previous planning for the Moroccan campaign in that we were to mount the operation from foreign soil and did not have at our immediate disposal all the facilities of the War Department and Ordnance establishments in the United States. Otherwise, the steps taken to evolve the Ordnance plan were quite similar. It was true that the original tactical plan was changed somewhat, resulting in the usual changes of Ordnance service requirements, some of which were too late to be reflected in the predicted Ordnance plan. For example, it was originally anticipated that considerable use would be made in Sicily of the M10 tank destroyers with their 3-inch guns. Actually, none were used in the operation although some 30,000 rounds of ammunition were received, together with a number of replacement M10's.

Ordnance supply planning was directly supervised by Col. (then Lieut. Col.) Nelson M. Lynde, who acquired immensely valuable experience and performed the job most capably. In this case, we could not prescribe over-all requirements in general terms. It was necessary to prepare detailed requisitions not only for supplies that would move with the assault forces but also for bimonthly convoys to arrive in Sicily for the succeeding four months. Suggestive of the enormous paper work involved is the fact that each set of bimonthly requisitions (six copies) weighed sixty pounds. We became painfully and acutely aware that the scope of our Ordnance catalogue comprises over 350,000 separate items, each one essential in the performance of U. S. firepower and mechanical transport. We knew that the organization of Ordnance Field Service back home would fill our prescriptions, accurately and on time, but it was up to us to see that each requirement was correctly prescribed in the light of experience in the North African campaign together with factors we could anticipate in Sicily.

Ordnance operations went according to plan. This time a greater proportion of the task force Ordnance troops debarked during the first few days of the invasion. Yet it was still apparent that additional Ordnance personnel should be ashore during the early beachhead stages to assist in the off-loading, movement, and proper disposition of Ordnance supplies. Tactical operations in Sicily moved so rapidly that there was comparatively little fourth-echelon maintenance performed during the actual campaign. However, there were no critical shortages of matériel, and the lower echelons of maintenance were satisfactorily performed both by using units and supporting Ordnance troops.

The port of Palermo was quickly opened. It is worth noting that by prior arrangement with our Air Forces, an Italian aircraft factory at Palermo, eventually used for an Ordnance depot, was spared from bombing. The same two Ordnance depot companies which had pioneered for us in Casablanca established a depot in Palermo that became one of the most efficient installations of its kind I have ever seen. Also, large quantities of Italian ordnance were reconditioned here for later use by ourselves and our allies, including many thousands of rifles and other small arms which had to be completely disassembled and rebuilt to make them serviceable.

DUE to rapid progress throughout the campaign, numerous ammunition supply points were required. The supply of ammunition became a twofold problem. First, there was the Ordnance problem of selecting the proper ammunition, seeing that it was placed on the proper transportation, then handling it upon arrival at the depot or ASP, and finally issuing ammunition in complete rounds to the using troops. Then there was the second problem concerning the best use of transportation in each instance where ammunition had to be moved. It is the writer's opinion that coördination was smooth and highly efficient between the ammunition subsection of the Ordnance staff and the transportation section to an extent seldom seen in a rapidly moving situation.

To illustrate the close teamwork which kept the combat units continuously supplied with necessary ammunition, the following example is given: At about the time when Seventh Army headquarters moved into Palermo, coaster vessels and LST's were being loaded with ammunition on the south coast of the island, proceeding to Palermo for instructions, then making deliveries along the north coast

where the ammunition was unloaded in close support of the combat troops moving eastward. There was no other means of transport, under conditions at that time and place, which could have moved the ammunition as efficiently or as quickly.

After the close of active operations against the enemy in Sicily, the Seventh Army staff spent some time studying possible amphibious action in the coastal area between Leghorn, Italy, and the Spanish frontier. As may be readily imagined, these preliminary studies paid dividends when Seventh Army was given the mission actually to plan the operation against Toulon, Marseilles, and the Rhone Valley, so nicely timed with the progress of U. S. armies operating in northern France. There were a number of interesting and significant developments concerning plans made for the invasion of southern France. The general procedure followed the pattern of planning for the Sicilian campaign and included careful study of all the topographic, climatic, and other local conditions to be anticipated.

However, the plan called for embarkation of troops at widely separated points, including practically all the ports of North Africa, southern Italy, Sicily, and Corsica. Also, plans were based on the probability of using troops which were then, or might later be, engaged in Italy during the planning period. In addition, a large French force—with thousands of French ordnance personnel—was to be an important part of the operation. All these factors required extreme detail and meticulous accuracy in planning, with all instructions relative to supply of Ordnance equipment written so that they could be concisely translated into French without danger of misinterpretation.

Throughout this work, Col. Herbert P. Showalter was in charge of planning for Ordnance general supply and ammunition. All the lessons gained from previous operations were considered for this operation against southern France, not the least of which was a study made after the close of operations in Sicily regarding certain changes in Standard Nomenclature List spare parts which appeared desirable in the light of combat experience. For example, the magazine of the Browning automatic rifle had always been in short supply. Normally, it wears out after certain usage; in Sicily many were lost after the soldier had exhausted the magazine on the battlefield.

On the other hand, other items on the SNL of spare parts were included mainly because, in the peacetime Army, they were extensively used for training and to keep weapons in superior condition; whereas they were less essential, and less extensively used, during combat. Supply estimates of Ordnance equipment and spare parts for this operation were made in accordance with the experience gained in the two preceding operations.

THE actual stages in supply planning for the invasion of southern France by the Seventh Army, in so far as they concerned the Ordnance plan, are given below in some detail.

(1) Preparation and constant revision of weapon and vehicle lists.

(2) Preparation of requisitions for general supply, including spare parts and replacement of major items to cover the period D plus 30 to D plus 60.

(3) Additional requisitions in general supply to cover special items which it was foreseen would be needed during the period D plus 1 to D plus 30, consolidated for deliveries on D plus 5, D plus 10, and D plus 20. All other initial supplies of spare parts and replacement items were to be taken in by Ordnance companies when landing.

(4) Requisitions for ammunition to cover shipments desired from the U. S. between D plus 30 and D plus 60.

(5) Requisitions for ammunition to be carried by troops in the initial assault and succeeding waves, based on landing with five units of fire, daily expenditure estimated at one-third unit of fire, and build-up after forty-five days ashore to a minimum of ten units of fire. This plan, which was very refined and a trifle complicated, required that troops landing in successive convoys had to carry not only their initial five units but, in addition, the necessary build-up stockage for troops already landed.

(6) Planning and nomination of units for the Ordnance troop list, taking into account the desired debarkation dates and the fullest possible utilization of French ordnance personnel.

For this operation a new plan relative to the landing of Ordnance troops was followed. The first Ordnance troops to land were to be ammunition companies, having the responsibility of establishing ammunition depots near the beaches which were later to revert to services of supply operating control. The day after these units had landed, army ammunition companies were to pass through the beachhead installations and establish ammunition supply points. In the same manner, at an estimated date several days prior to the capture of ports at Toulon and Marseilles, Ordnance base depot companies were scheduled to land, together with more services of supply ammunition companies so that they might initially set up and then continue to operate the base installations at these ports. Similarly, maintenance and supply units for our Ordnance would be brought in later, pass through the base areas, and move into the zone of army Ordnance Field Service. For this operation, it was planned to land approximately 2,750 Ordnance personnel on D-day, which was a relatively considerable departure from earlier operations.

I received orders to proceed to the United Kingdom and join the Third U. S. Army, commanded by General Patton. In this case, the Third Army's function in preparing for operations in France was somewhat different from our previous experiences. Previously, the army's Ordnance section had been responsible for the coördination of all elements in the Ordnance plan whether they concerned army or services of supply. Here, the Third Army was one of a group of armies and services of supply for which planning had been done separately and coördinated for all the armies by Headquarters, European Theater of Operations. Army was asked, however, to make detailed plans for supply of troops landing up to D plus 41. Also, for troops arriving after that date, we were asked to provide weapon and vehicle lists, together with ammunition requirements up to the time when the Third Army was considered to have completely assembled on the Continent.

After the arrival of Third Army Ordnance units on the Continent, before the army became operational, it was possible to accomplish much toward the organization and field training of our units for efficient service. This

short period enabled many battalion commanders to gain more intimate contact both with their companies and with higher headquarters' staffs. In some cases, Ordnance units from Third Army were afforded the opportunity to operate temporarily with the First Army. In all cases, the field conditioning was excellent preparation for the strenuous days to come, after the Third Army became operational, and we all became better acquainted so that Third Army Ordnance emerged from this brief period as a team ready to carry the ball for our combat divisions when they should take off.

ON August 1, 1944, when the Third Army became operational in France, there was little stock in the hands of army Ordnance supply units other than organically carried replacement items, spare parts, and ammunition. Furthermore, within a few days the army's combat teams were on their way south through the Avranches Gap beginning the long end run which carried our divisions as far south as the Loire, west to Brest, and east to Chartres, Paris, Verdun, and finally to the Moselle River. To begin with, all efforts were made to build up additional supplies for the support of a very fast moving army. At this stage as, indeed, throughout operations to date, the complete cooperation and support of the advanced section, communications zone, made it possible for us to get by in meeting our ammunition and other ordnance requirements.

All means of transportation were used to bring forward the necessary ammunition on what became virtually a day-to-day basis. Army supply points and depots were so located that they remained along the axis of advance and did not subsequently have to be moved laterally. When certain types of ammunition were becoming depleted, even the tank transporters and other cargo-carrying vehicles of maintenance units were called on to haul ammunition. Also, at various stages of the advance, ammunition was flown up by air transport to be landed at air strips a few miles behind the front lines. We never moved a ton of ammunition without thinking twice to make sure it was being moved to the exact place it was then needed and could be used without unnecessary shuttling about later.

It is significant that to date, throughout practically all operations of the Third Army in France, ammunition supply points will be found much farther ahead, as a rule, than any other supply installations. There have been, of course, some hazards in the operation of ammunition supply on this basis. However, there have been relatively minor losses from air bombing. In one instance, an ASP manned by colored ammunition companies was heavily bombed by four waves of planes and there was no loss of life. The conduct of the Negro soldiers at this installation was excellent and a number have been decorated.

The bottleneck at Avranches in France, shortly after the break-through, presented a serious problem in obtaining the movement forward of supporting Ordnance troops because of the constant demand to bring up more of the combat units. Units of Third Army Ordnance were moved, as the opportunity arose, some by infiltration of seven vehicles at a time, to new areas south of the bottleneck. With the subsequent movement of some divisions westward on the Brittany Peninsula and others to the south, while the base of supply remained in Normandy above the Avranches bottleneck, the distribution of Ordnance supplies to meet all contingencies became very difficult.

The solution adopted at this time was to hold the main stock of supplies at proper pivotal points so that, even though it became necessary to operate daily convoys to the west and south, the bulk of our supplies was never moved far from the road they would eventually follow when the main part of the army turned east toward Paris. Finally, our line of communications looked like a distorted and inverted "T", with the vertical axis extending 80 miles into Normandy, while the main axis lengthened to over 450 miles east and west. Later, of course, these lines grew still longer, but, by this time, we had the support of numerous installations in the communications zone.

In operating the army maintenance service, we have followed the principle of always keeping forward maintenance units close behind the combat forces, bringing our repair facilities to the points where they are needed, whenever possible, rather than evacuating damaged matériel to the rear. We have found that considerable damage and deterioration inevitably occur during and pending evacuation. This can be eliminated by moving shop facilities forward. There are two army maintenance groups, one of which controls the forward Ordnance maintenance battalions, while the rear group also has tentacles which reach into the forward area to carry the heavy maintenance load.

An example is the location of heavy automotive maintenance companies along main highways in the forward areas where they operate collecting points and make all type major repairs on wheeled vehicles. When it becomes necessary to move such a unit forward during an advance, the rearmost heavy automotive maintenance company reverts its unfinished work to a supporting advanced-section communications-zone unit and then moves forward, "leapfrog" fashion, to become the forward company along that particular highway. Units of the forward maintenance group retain their mobility by relying on the foremost units of the rear group to relieve them of jobs which require an appreciable time.

AS one drives along the highways of France and observes the great amount of destroyed enemy armor, weapons, and motor transport as compared with the relatively negligible amount of U. S. equipment, he cannot but be impressed with the notion that not only is our American equipment superior, but also that the men who have made it, who fight with and maintain it, are more competent than the enemy.

The work done by the Ordnance soldier and officer in the field is unsung. It never appears in the headlines. The soldier handling ammunition at the supply points, possibly under bombardment; the depot soldier hauling, storing, and issuing supplies, suffering casualties and seeing his buddies killed or wounded but continuing on his mission, the bomb-disposal expert who disarms live bombs that others may not be injured; the patrol mechanic who brings his service to front-line gun positions; the supply technicians who faithfully keep the records and skillfully plan the movement which makes possible the operation of our complex supply and maintenance organization—these are the men who have contributed in no small measure to success in battle, for modern warfare is, as much as anything else, a war of maintenance and supply.

Incendiary Warfare

Modern Fire Weapons Can Cause Tremendous Destruction

Col. George J. B. Fisher

The motivating principle behind incendiary attack is that in most targets there is an inherent element of potential self-destructibility called the "fire potential." To fully exploit this vulnerability of the target is profitable because fire raising has now become relatively cheap in terms of military effort and because fire destruction is thorough.

AT the outset of every recent war there has arisen an immediate and insistent demand for incendiary munitions. The improvisations that had to be supplied to meet such demands always proved disappointing. As a result, between-war development of incendiary weapons seldom attracted the serious attention of munitions experts, most of whom were inclined to rely on explosives for incendiary effects.

The recurring cry for incendiary munitions at the outset of wars may be seen as a popular recognition of the destructive force inherent in fire. Later decline of interest has, in the past, been a tacit admission of the inadequacy of means at hand to produce the results desired.

However, remarkable progress has been made in the field of incendiary munitions during the present war. What once was an almost occult science now has become a well-defined branch of military technology. Fire-raising weapons are at last capable of satisfying most tactical demands; consequently, incendiary warfare cannot hereafter be neglected by any major military power.

Two factors have contributed to the rise of military incendiarism to the status of importance it has finally achieved in this war. The first is an indirect result of the fact that the war has now lasted well through its sixth year. During this time, the complex technical problems involved in fire raising on a military scale have commanded such sustained study that some satisfactory solutions have at last emerged.

Of equal importance is the present availability of air power for distributing incendiaries in the quantities required for positive results. In fact, the incendiary bomb has come to be one of *the* weapons of strategic air forces. Incendiary warfare as we think of it today is essentially an instrument of air power.

Efforts to devise an efficient incendiary shell for artillery weapons never proved altogether satisfactory. There is today no standard incendiary-loaded shell for U. S. artillery. This is eloquent testimony to the difficulties of reconciling the ballistic requirements for long-range projection from cannon with the thermodynamic requirements for efficient fire starting. The most effective of present incendiaries are best cased in thin or malleable-walled containers and so are much more satisfactory for release from the air than for discharge from guns.

The incendiary, like all chemical munitions, produces a reaction that is relatively slow—at least in comparison with the speed of explosion. Its specific job is to heat an object until that object attains a temperature at which it can support its own combustion, and that takes time.

The thermochemical force again is modest compared to the force generated by explosion, which is another way of saying that this force is spread out rather than concentrated in time. The real power of the incendiary, wherein it particularly differs from the high-explosive weapon, is the unique capacity for radiating to other objects the type of force it represents. This is something the explosive can scarcely do. The force of the explosive is contained within itself. The force of fire destruction is contained within the target; the incendiary merely invokes that force.

Explosive shell and explosive bombs do, of course, produce fires, both directly and indirectly. Yet such fires, even though they are occasionally of some magnitude, are incidental and cannot compare in scope to those produced by intensive incendiary attack.

THE detonation of a high-explosive bomb is accompanied by the generation of an extremely high-temperature flame. Once the case ruptures, this flame front moves rapidly in all directions. Yet it normally dies at a distance of probably not more than fifty times the diameter of the projectile. And, what is more important from the viewpoint of incendiary effectiveness, its duration is extremely brief. Unless combustible gases are present within the area covered by the flame front, the flash quickly expires, and the high pressures of both phases of the blast wave serve to deter ignition even where conditions are otherwise favorable.

Many more fires result indirectly from the earth shock and the blast effects of bomb detonation than are

Colonel Fisher is commandant of the Western Chemical Warfare School, Rocky Mountain Arsenal, Denver, Colo. He is preparing a book on incendiary warfare which will be published in the near future.

caused by ignition from the momentary flash of burning gases that accompanies the initial burst. Ruptures of gas mains, sympathetic detonation of sensitive explosives, shattering of structures, all conduce to fire incidents so that a high-explosive bombing attack in strength against the average urban target is almost certain to produce a number of appliance fires. When fortune favors the attacker, these fires sometimes attain serious proportions.

Nevertheless, the ratio of incendiaries to explosive bombs, in terms of total bomb weight carried on strategic missions, has steadily increased in the present war, culminating in the fire raids on Tokyo, Nagoya, and other industrial cities of Japan.

The bombings of the Renault works near Paris afford an interesting case history of the effectiveness of explosive bombs against an industrial target, especially since, for reasons probably of political nature, no incendiaries were ever used in attacking this plant.

The initial attack by the RAF in March 1942 put the main works out of production. But within less than a month production was resumed, and the rate climbed steadily until in about four months the plant had been rebuilt and was operating at full capacity.

In April 1943, Renault was attacked again, this time by the Eighth Air Force, dropping 250 tons of heavy high-explosive bombs. Again production was suspended, only to be resumed once more in less than a month. Subsequent attacks resulted in the same succession of shutdowns, followed by gradual resumptions, until finally the plant fell into allied hands. From the AAF saturation attack in April 1943, it is reported that 20 per cent of Renault's shops were wrecked, 500 machines destroyed, 1,000 machines badly damaged, and 2,000 slightly damaged—which proved to be a serious yet not an irreparable blow to production.

Although no exactly comparable data are at hand as to entirely incendiary attack of a similar target, there is ample experience to prove that plants destroyed by fire are plants gutted and left usually beyond recuperation.

Some light on relative effectiveness of explosive and incendiary bombing may, however, be gained from analysis of attacks against certain Pacific island installations. In many of these localities the same general pattern is presented: a clearing of dense tropical growth to a distance of a mile or less back from the waterfront, just sufficient to accommodate compact establishment of warehouses, naval and port facilities, and housing—with air installations some distance removed.

Such a target was attacked by formations of the 7th Bomber Command in five operations during February 1944. In the first attack, eighty-two tons of explosive bombs were dropped, which destroyed or damaged only eleven buildings. Attack was renewed three days later with eleven tons of explosives, still without positive results. For the third attack, 2½ tons of incendiaries were dropped along with 29 tons of explosive bombs under low-visibility conditions which prevented accurate evaluation of damage, although results were still inconclusive.

FOR the fourth operation, all-out incendiary attack of the port was tried by dropping ten tons of oil bombs. The whole town was soon a blazing inferno, the water front completely wiped out, a fire swath cutting clear across to the foothills fringing the settlement and razing over 300 buildings. The fifth and final attack was then a mopping-up operation with both explosives and incendiaries to take care of outlying structures that had escaped the path of the initial conflagration.

This and many similar actions in the present war clearly demonstrate the completeness and the economy of destruction that can be accomplished by incendiary bombing. At the same time it is obvious that incendiaries cannot substitute for explosives against many types of targets; even where fire effect is the principal object, explosive bombing is still an essential adjunct.

There has been some disagreement in the past as to whether a primarily incendiary attack of an area should be preceded, accompanied, or followed by dropping of explosive bombs. The particular arguments advanced in favor of bombing with explosives before an incendiary attack have been: (1) to increase the inflammability of structures, and (2) to disrupt supplies of water for extinguishing fires.

From considerable data now available it is evident that the first of these arguments cannot be supported. Standing structures are ignited much more readily than rubble. Where areas have been bombed over first with high explosives, good results are not obtainable with incendiaries. This fact has been demonstrated so clearly as to influence the designing of the present standard types of fire bombs.

But disruption of water supply or distribution systems is important to the success of the incendiary attack and in fact points to the proper rôle of the explosive bomb where the primary objective of the operation is destruction by fire—its rôle being essentially that of a supporting weapon. Where water installations can be selectively bombed, their destruction is worth while.

The bombing of an already burning area with high explosives serves to impede the efforts of fire-fighting personnel, but heavy demolition bombs also serve as an effective means for extinguishing fires. As early as 1827 Maj. Gen. Sir William Congreve pointed out that the "great use of shells is to prevent the people from extinguishing the conflagration." Fragmentation bombs have been found to be reasonably effective in restraining firemen without impeding the progress of the fire. These, of course, must be detonated while fire fighting is in progress; that is, some time after the incendiary bombs have been dropped.

The pattern of a typical incendiary attack from the air is thus established. The operation may be initiated by demolition of water supplies, where this can be accomplished without impairing the combustibility of the target, or may be preceded by any similar high-explosive missions that promise to further the principal objective. Incendiaries are then laid on the target in types and quantities calculated to accomplish appropriate fire destruction. Finally, fire-prevention efforts are voided in so far as practicable by fragmentation bombing or by other means, which may even extend to machine-gunning.

There are infinite variations as to planned incendiary operations, according to conditions in the target area, yet the foregoing sequence has on the whole proved most effective. Later, when fire destruction is complete, any remaining objects that have withstood burning may be bombed for demolition if their reduction is necessary.

THE MEDICAL DEPARTMENT AT WAR

Ambulances of the Army's Medical Department hit the beach shortly after the Normandy invasion.

THEY CARRY NO GUNS into battle and fire no shots at the enemy, but the men of the Medical Department of the U. S. Army are always in the forefront of combat sharing the dangers—and very little of the glory—with our fighting troops in every theater of operations.

They do carry weapons, however—weapons of mercy against shock, infection, and death—and they study the strategy and deployment of combat troops so that they may be on hand in sufficient numbers and with enough supplies to aid our soldiers where the fighting is thickest.

Originated in 1775, the Army's Medical Department today has a staff of 45,000 doctors, 40,000 nurses, 16,000 dentists, 2,000 veterinarians, 17,000 administrative officers, 2,000 sanitary corps officers, and 600,000 enlisted men serving in first-aid, litter-bearer, and other capacities.

Our soldiers have been exposed to every known disease under the most difficult field conditions in every part of the world. They have suffered every type of battle wound. Yet, due to the magnificent work of the Medical Department, ninety-seven per cent of the wounded who reach hospitals live, and the disease rate in the Army is only one-twentieth as high as it was in World War I—a great medical achievement.

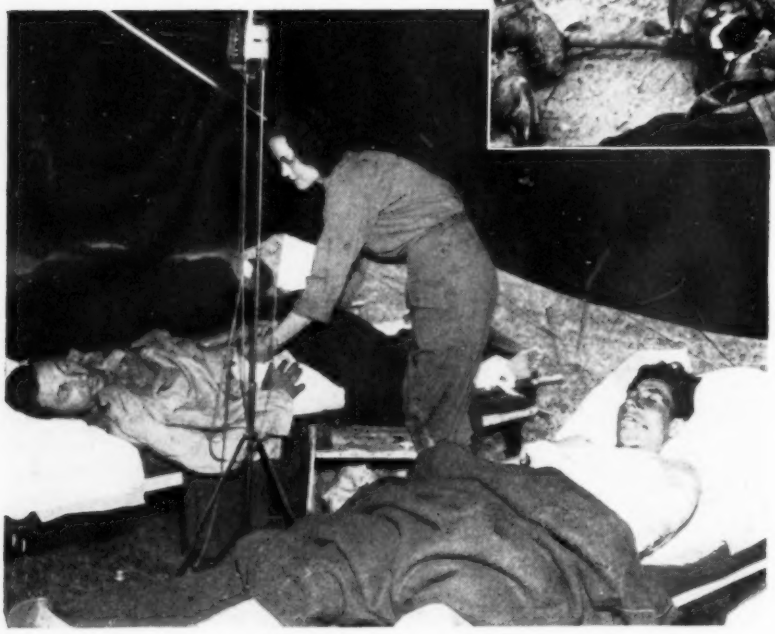
To accomplish these results, all the resources of modern science have been called into play. Mobile X-ray, operating, and optical units have been developed. Blood plasma and whole blood administered at the very front have saved thousands of lives. By air and by sea, wounded men are evacuated to hospitals in theater headquarters and to the United States. And for the first time in any war the soldiers themselves begin treating their wounds right on the battlefield by sprinkling them with sulfa drugs carried in their field packs.

When a man is wounded he either walks or is carried by litter bearers to a battalion aid station located a few hundred yards behind the front lines. Depending upon the severity of his injury, the soldier is then sent back through a field hospital, evacuation hospital, base hospital, perhaps finally to a general hospital of which there are over 60 in the United States alone with a total capacity of 100,000 beds.

Mercy in the midst of war, rehabilitation from ruin, life from the shadow of death—such is the mission of the Medical Department of the U. S. Army. (Accompanying illustrations showing the Medical Department in action are from Signal Corps photographs.)

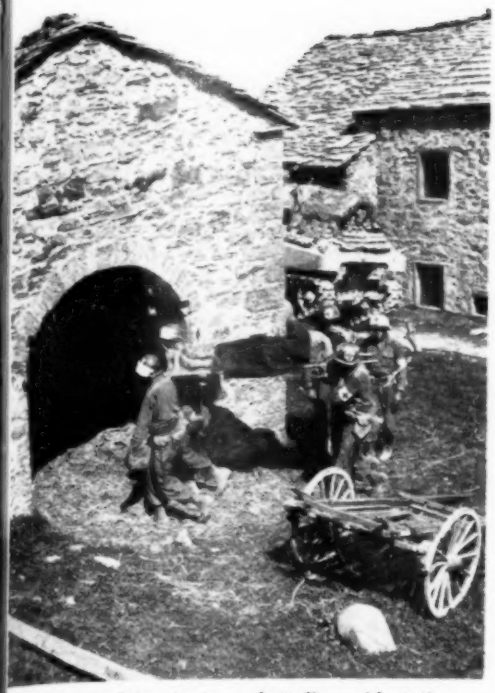
Evacuation hospitals such as this are located from 15 to 50 miles behind the front lines. Here the wounded are brought from clearing stations and given major medical or surgical attention. This hospital has about 750 beds and a staff of 400.

American medics give first aid to one of their own number wounded in the initial landings on the northern coast of France. The men of the Medical Department accompany even the first waves of an invasion to aid American wounded under fire.



"Angels in white" become angels in khaki dungarees at a clearing station near the front lines, but they are still a cheering sight to the wounded men who come under their care. The Army has about 40,000 nurses now in uniform but could use many more. They are indispensable both at home and abroad.

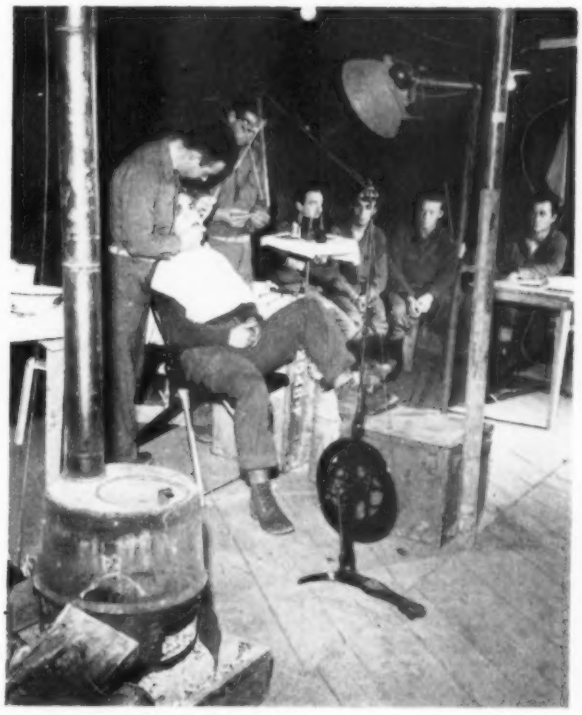
During a lull in battle, two soldiers bring a wounded buddy to a battalion aid station for treatment.



Litter bearers bring in to a battalion aid station a soldier wounded in the Gothic Line battle. If he requires further medical attention he will be sent by ambulance or jeep to a collecting station and then later to a clearing station near the front.

This operating room in an evacuation hospital contains 6 operating "tables" consisting of "horses" made of metal tubing on which the litters are placed. This eliminates the necessity of removing patient from litter to an operating table. Muddy overshoes of the doctors indicate nearness to the front lines.

The Medical Department carries on, too, in the mud and jungles and islands of the South Pacific. Here wounded are being taken off a landing craft to a waiting ambulance for evacuation to the 43rd Division Hospital.



The Army has some 16,000 dentists who serve with the troops in every phase of combat—with ski troops, with paratroops, aboard hospital ships, and in all combat zones. Dentists have followed our soldiers in every invasion.

American medics are in the thick of every action, ready to give first aid to wounded GI's almost as soon as they are hit. Litter bearers then carry the wounded to safety.

Medical aid men unload wounded soldiers from ambulances and place them aboard a hospital train somewhere in France. They are bound for a general hospital in Paris where they can receive major medical and surgical care. Some may later be evacuated to the United States.

The wounded and sick are also removed from the combat zone by ambulance planes such as this one which has just landed in India with a load of injured who will enter a Medical Department hospital there. Planes also bring seriously wounded soldiers to the U. S.

The Army's medical program requires medicines in huge quantities, and trained pharmacists are employed in compounding the many prescriptions needed for restoring the health of sick and wounded soldiers.

The more than 60 Army general hospitals in the United States are expressly designed to deal with the physical and psychologic rehabilitation of soldiers who cannot be returned to active duty. There are 8 hospitals for plastic surgery, 19 for neurosurgery, 5 for chest surgery, 3 for deafness, 2 for blindness.

The story of the performance of the Army Nurse Corps from Pearl Harbor to Bataan, from North Africa to the Rhine and beyond, is one of patriotic devotion and courage. The ever-smiling Army nurse, perhaps more than any one else, has kept the morale of our wounded fighting men at high pitch. They have done a great job but more are needed.

The Age of Oil

The Influence of Armament on World History—VI

Maj. Gen. J. F. C. Fuller

WHEN the nineteenth century was in its last lap, and during those years in which the nation in arms was entering the saurian stage of its development, inventions destined to revolutionize the conception upon which it was founded began to take practical form. The two most fateful were the internal-combustion engine and wireless telegraphy. The first was a direct consequence of the rapid production of petroleum in the United States from 1859 onward, and the origin of the second may indirectly be traced back to the year 1842, when Samuel F. B. Morse first experimented with an interrupted metallic electric circuit.

As a commercial proposition, the gas engine was first introduced by Dr. N. A. Otto in 1876. Nine years later Gottlieb Daimler improved upon it, and, by fitting a small petroleum spirit internal-combustion motor to a bicycle, he produced the first petrol-propelled vehicle. Next it was adapted to 4-wheeled carriages, and in 1895 the first automobile race was held. It was from Paris to Bordeaux and back, the winner covering the 744 miles at a mean speed of 15 miles an hour.

Then came the most revolutionary of all its triumphs. On December 17, 1903, at Kill Devil Hill, Kitty Hawk, N. C., Orville Wright in a power-driven airplane flew for twelve seconds. Six years later Blériot in a monoplane spanned the English Channel between Calais and Dover in thirty-one minutes. Thus, after 3,000 years, did the legend of Dædalus become true history. A power had been born which within half a century was destined to change the face of war, for the thunderbolts of Jove could once again be hurled from high heaven.

The second invention—wireless telegraphy—was first given theoretical form in 1887 by Rudolf Hertz. He proved that under certain conditions an electrical spark creates an effect which is propagated out into space as an electric wave. This led to Guglielmo Marconi turning his attention to the invention of a device which could detect these waves, and so successful was he that in 1897 he transmitted a wireless message over a distance of 9 miles, and in 1901 over 3,000 miles.

These two inventions introduced warlike possibilities which went far beyond anything as yet accomplished by either gunpowder or steam power. The first not only led to a revolution in road transport and consequently in land warfare, but by solving the problem of flight it raised war into the third dimension; whereas the wireless virtually raised warfare into the fourth dimension, for to all intents and purposes the wireless transmission of energy annihilated time as well as space. Thus two battlefields were gained—the sky and the ether—the one to be dominated by the airplane and the other by the radio.

These changes, as well as others resulting from scores of less prominent inventions, when coupled with the strides made in the metallurgical, chemical, electrical, biological, and other sciences, set in motion forces very different from those released by coal and steam.

DIVORCED from civil progress, soldiers could not see this. They could not see that, because civilization was becoming more and more technical, military power must inevitably follow suit and that the next war would be as much a clash between factories and technicians as between armies and generals. Even M. Bloch, that far-sighted man, could not see that the sole thing impossible in war was for it to stand still.

Few soldiers and sailors were even as clear-sighted as he. And those who were, failed like he to see that industry and science had already placed in their hands weapons of such power that, if rightly combined, they could prevent a war of pure attrition. The majority were hostile to novelty; nevertheless faith in a war of movement abounded, and in this respect bulk military outlook was diametrically opposed to Bloch's. For instance, in 1912, a French soldier of distinction wrote: "In a war between France and Germany we do not anticipate a battle of such a nature [*i.e.*, an entrenched battle]. . . . Battles in entrenched camps as occurred at Plevna or Mukden will never take place in a war with the French Army."

The godhead of this heresy comprised Generals Foch, Grandmaison, and Langlois, who established a school of thought rivaled only by the dervishes of the Sudan. The leading principle was that morale was the infallible answer to the bullet—a piece of pure witchcraft. Foch quoted approvingly the words of Joseph de Maistre: "A battle lost is a battle one thinks one has lost; for a battle cannot be lost physically." To which Foch added: "Therefore it can only be lost morally. But then, it is also morally that a battle is won, and we may extend the aphorism by saying: *A battle won, is a battle in which one will not confess oneself beaten.*"

Coupled with this sophistry, he believed that "Any improvement of firearms is ultimately bound to add strength to the offensive"; consequently in battle there was but one principle to follow—namely, attack! What he could not see was that to render attack profitable a return must be made to the essence of the Napoleonic offensive—"It is with artillery that war is made."

On December 17, 1903, at Kill Devil Hill, Kitty Hawk, N. C., Orville Wright in a power-driven airplane flew for twelve seconds. Six years later, Blériot in a monoplane spanned the English Channel between Calais and Dover in thirty-one minutes. Thus, after 3,000 years, did the legend of Dædalus become true history. A power had been born which within half a century was destined to change the face of war, for the thunderbolts of Jove could once again be hurled from high heaven.

General Fuller, noted British soldier-author, is one of the outstanding military analysts and historians of the present day. As an officer in World War I he was one of the foremost advocates of tank warfare and did much to mount the armored attacks that proved the value of the bullet-proof track-laying vehicle. He is a Companion of the Bath, a Commander of the Order of the British Empire, and a Companion of the Distinguished Service Order.

In part, Count von Schlieffen (1833-1913) saw this, and to render the attack superior to the defense he increased the number of the German heavy guns; but he did not see that this in itself was insufficient and that true superiority could only be gained by building a new fighting organization around the gun.

This was the dominant tactical problem which faced all armies after the Russo-Japanese War, and it was by no means an occult one, for it was clearly seen by myself when a student at the Camberley Staff College in 1914.

Because, in my opinion, the quick-firing field gun and the machine gun were the dominant weapons, I suggested that tactics should be molded around them. "We can predict with absolute certainty," I wrote, "that the general who makes the truest use of these weapons—that is, so deploys his men that their fullest power is attained —will win, unless he is hopelessly outnumbered." I predicted that because the field gun "is now the master missile-throwing weapon," it would "revolutionize the present theory of war by substituting as the leading grand tactical principle penetration for envelopment." I further suggested that it should be supplied by motor transport and that the forces of the infantry decisive attack should be organized around the machine gun.

Today, I see no reason to doubt that, had the German armies of 1914 been organized around the field gun and the machine gun—the two dominant weapons of that period—instead of around the rifle—the dominant weapon of the nineteenth century—they would have overrun France nearly as rapidly as they did by means of two very different dominant weapons—the tank and the airplane—in 1940.

Because this central tactical problem was not seen, when war was declared in July 1914, faulty arrangement of weapon power, more so than lack of it, endowed the bullet on the defensive with such superiority over the bullet in the attack that, within a few weeks of the war's opening, field warfare gave way to siege. Thus was Bloch's forecast proved correct to the letter, not because he was right, but because neither he nor any of the belligerents had rightly seen the problem.

Stalemate setting in, the problem next became one of how to reinstate mobility, and its solution was sought in ever-increasing shellfire. Nevertheless, as a prime mover, the shell failed badly because the effectiveness of artillery had been largely reduced by the growth of field works and entanglements—defenses which barely existed in the opening phase of the war, and which could not be extensively built until fighting became static.

Though the reliance placed on volume fire—bombardments of obliteration—could generally guarantee an initial success by destroying forward communications, it created for both infantry and artillery movement and supply as formidable an obstacle—the cratered area—as the trench systems and entanglements it had destroyed. Thus, though the dominant weapon—the gun—came into its own, because it lacked mobility (range of movement) it could not play the part of a decisive weapon. Nor could the infantry, because they also were bunkered by the crater area. The upshot was that, instead of stalemate being liquidated, it became more complete.

THE war having been reduced to a siege operation, reliance was placed in blockade, which, on account of the range and volume of its "striking power," has always been the dominant "weapon" of the economic attack. The German answer to this was unrestricted submarine warfare.

To break the blockade was not a naval but a military problem. In the case of Germany, it was how to penetrate her enemies' fronts in order to extend her food area; that is, shorten the range of the blockade. In the case of France and Great Britain, penetration was also the problem, the aim of which was the elimination of the German U-boat bases.

As artillery could not solve this problem, in 1915 the Germans turned to lethal gas, launching the first chemical attack on April 22nd. But on account of the ease in neutralizing poison gas, the problem remained unsolved. Nevertheless, vesicants, such as mustard gas (dichloro-ethyl-sulphide), proved to be formidable weapons.

Both sides also resorted to air attack on each other's civil populations and industrial areas; but it was no more than a side issue, for though this form of the offensive pointed to an enormous future, air power was not as yet sufficiently developed to produce decisive results.

Both these solutions were spurious, because the problem was not understood. It was how to neutralize the bullet; therefore, how to disarm the mass of the enemy's riflemen, not gradually but instantaneously. Clearly the answer was bulletproof armor and not an increase in projectiles, whether bullets, shells, bombs, or even gas. Quite early in the war this was seen by Col. E. D. Swinton and others in Great Britain. Further, they saw that, though the soldier could not carry bulletproof armor, he could be carried, as the sailor is, in a bulletproof armored vehicle, and that as this vehicle would have to travel across country it must move on caterpillar tracks instead of on wheels. Thus was the tank, a self-propelled bulletproof landship, conceived. On September 15, 1916, it first went into action on the shell-blasted battlefield of the Somme.

Ever since the introduction of firearms, the two outstanding difficulties in battle tactics had been how to harmonize movement and fire, and movement and protection. These were now overcome by the tank. It increased mobility by substituting mechanical power for muscular power. It increased security by neutralizing the bullet by armored plate, and it increased offensive power by relieving the soldier from the necessity of carrying his weapons and the horse from hauling them. Protecting the soldier dynamically, the tank enabled him to fight statically; therefore it superimposed naval tactics on land warfare and mobilized infantry.

The first time tanks were skillfully used was in the Cambrai attack, on November 20, 1917. In this battle no preliminary artillery barrage was employed. Instead, grouped in threes, tanks operated as a chain of mobile armored batteries slightly in advance of the infantry. With certain modifications, these tactics were maintained until the end of the war, and as the following figures go to prove, they resulted in a vast reduction of casualties to territory gained. In the Battle of the Somme (July to November 1916) British killed and wounded numbered 5,277 to each square mile conquered; in the Battle of Passchendaele (July to November 1917) casualties numbered 8,222 per

square mile; but between July and November 1918, when tanks were extensively used, casualties were reduced to 86 per square mile!

In 1917 and before the Battle of Cambrai was fought, a plan was devised by me to carry machine gunners through the enemy defenses, depositing them in rear of them while his front was being attacked, and special tanks were built for this purpose. In 1918 I substituted another plan, which was accepted by Marshal Foch for the 1919 campaign. Instead of launching the initial attack against the enemy's front, it was decided to launch it against his rear—his command and supply system—by suddenly and without warning passing powerful tank forces, covered by aircraft, through his front. Next, directly paralyzation of his rear had disorganized his front, a strong tank and infantry attack of the Cambrai pattern was to be launched against that front.

Thus, what twenty years later became known as the *Blitz* attack, was born, and, had the war continued into 1919, seeing that the Germans had no properly ordered antitank defense, these tactics would have produced even more startling results than they did in 1939-1940.

THIS world-wide war, the origins of which were mainly financial and economic, was, as M. Bloch had foreseen, finally decided by famine, bankruptcy, and the breakup of the whole social order in the defeated countries. Blockade was its master weapon, as it cannot fail to be when time is sufficient to permit of its range taking effect, because the "volume" of its "striking power" is total, hitting every man, woman, and child, as well as every factory and frequently all farm lands in the area laid under siege. Second to it came the tank, the moral effect of which vastly exceeded the physical damage done, because in the face of its assault the German soldier felt himself to be, as he actually was, impotent. Ludendorff was right when he christened the great tank victory at Amiens, on August 8, 1918, "The black day of the German Army."

The revolution following the war was complete. Politically, it destroyed three empires—the German, Russian, and Austrian. Economically and financially, it ruined the defeated nations, and, with the exception of the United States, it bled white the victorious.

THIS sixth in General Fuller's series of articles on the influence of armament on world history traces the development of the internal-combustion engine and the radio from their beginnings in the nineteenth century up to the present day, showing the vast changes they have wrought in modern warfare.

The first article, "Armament and World History," appeared in the July-August 1944 issue; the second, "The Age of Valor," in the September-October number; the third, "The Age of Chivalry," in November-December; the fourth, "The Age of Gunpowder," in the January-February 1945 issue; and the fifth article, "The Age of Steam," in the March-April issue. The last installment will appear in ARMY ORDNANCE for July-August.—EDITOR.

The means of fighting were also revolutionary because, for the first time in the history of war, battles were as much tussles between competing factories as between contending armies. The production of weapons more so than the conscription of men was the deciding factor in battle. God now marched with the biggest industries rather than with the biggest battalions, and with the tank and the gun more so than with the rifle and the bayonet.

As is nearly always the case in great wars, it was the losing side which learned most. Whereas the victors looked upon the war as an incident which had been liquidated, the vanquished saw in it a consequence of faulty actions. To the U.S.S.R., to Germany, and in a lesser degree to Italy, the four supreme war lessons were: The increasing necessity (1) for political authority in war, (2) for national discipline in war, (3) for economic self-sufficiency in war, and (4) for technology in war. And if in war, then in peacetime also in order to be prepared for war.

This led to autocracy, regimentation, autarchy, and mechanization; together, to a new conception of civilization. In the U.S.S.R. and Germany, military power was no longer looked upon as the protector of national existence, but as its regenerator. Thus it came about that the vanquished nations inverted Clausewitz's famous saying that "war is a continuation of peace policy" and replaced it with "peace is a continuation of war policy." Meanwhile, like medieval sorcerers, the victorious sought to attain their end—a return to the *status quo* of 1913—by solemn conjurations. They anathematized war, and, like the Lateran Council of 1139, attempted to interdict the newer weapons.

DURING the war, these weapons—the airplane, tank, and lethal gas—had been used experimentally. What did experiments point to? In each case to an extension of gun power, the gun being the dominant weapon. Thus, the tank had been used as a self-propelled armored gun; the airplane as a long-range cannon or machine gun, and lethal gas as molecular shrapnel. Had these experiments been carried further, as they would have been had the war lasted another year, it would have become apparent that in themselves tanks and aircraft were not weapons but instead vehicles in which weapons could be carried.

Further, it would have become apparent that as their dominant characteristics were new means of movement, rendered practical by the common prime mover—petroleum—entirely new fighting organizations could be built around the tank and the airplane; namely, self-propelled armored armies and air-borne armies, and not merely self-propelled armored guns and air-borne artillery.

In this evolution the essential factor was oil, as in the nineteenth century it was steam. Nevertheless, though as General Denvignes pointed out after the war, "Without a national carburant there is no national independence," and though Lord Curzon said, "Who has the petrol has the Empire," for purposes of war, oil cannot be fully exploited as a prime mover unless fighting power is organized around it. Fighting organization and not merely an extension of gun power was the problem.

This was not appreciated by any single nation in spite of the fact that the tank tactics revised by myself for the 1919 campaign could only be developed by a self-propelled armored army supported by a powerful air force. The first was to comprise the following machines: three types of fighting tanks, an armored infantry carrier, two types of bridging machines, an engineer tank, a mine-sweeping tank, a lethal-gas tank, a recovery tank, a radio tank, and a supply tank. The sole important weapon lacking was an armored self-propelled field gun: unarmored self-

THE internal-combustion engine and the radio introduced warlike possibilities which went far beyond anything as yet accomplished by either gunpowder or steam power. The first not only led to a revolution in road transport and consequently in land warfare, but by solving the problem of flight it raised war into the third dimension; whereas the wireless virtually raised warfare into the fourth dimension, for to all intents and purposes the wireless transmission of energy annihilated time as well as space.

propelled 60-pounder guns and 6-inch howitzers were already in existence.

In spite of its juvenile imperfections, such was the first combined land and air army planned to fit the war demands of an advancing technical civilization. In idea and in armament it was as different from the Napoleonic mass armies as were the armored feudal levies from the armed barbarian hordes they replaced. Tactically, there was a closer relationship between the feudal and the technical orders than between the technical and the Napoleonic, because in the feudal and the technical the tactical elements were more closely integrated. In the one, armor (protection) and the *arme blanche* (offensive power) were coördinated by the horse (motive power); in the other, armor and projectile power were coördinated by the internal-combustion engine. Therefore, as in both the central idea was the development of protected mobile offensive power, logically I urged the study of medieval warfare.

THE problem was how to integrate the three tactical elements, and it was not clearly seen by either Russia or Germany—the two leading military powers in 1939. Instead of integration, in the main they adhered to the separation which during the first World War had existed between what may be called the old "handicraft" army and the new "machinecraft" forces. This led to the adoption of a neo-Napoleonic organization; that is, an army based on the principle of the nation in arms, to which were attached as appendices the new technical arms and services, coöperating instead of being combined with it.

A mistake, however, which the Russians and Germans did not make was to separate their air forces from their land forces. They were not misled by the theory of absolute air warfare as expounded by Douhet, Mitchell, Seversky, and others, who looked upon the airplane as being so dominant and so decisive a weapon that its powers rendered those of all other weapons nugatory.

It is of importance to outline this theory, because the misuse of a weapon, as much so as its correct use, by influencing war influences history.

On account of its range no one will dispute the dominance of the airplane; but that it is a master weapon, as once was Greek fire or for a brief moment Charles VIII's cannon or as the rifle still is today against ill-armed savages, is clearly an exaggeration.

IN brief, the Douhet theory was as follows: As fighting power is based on industrial production and civil morale, once it is deprived of these two sources of energy it must automatically collapse. Therefore all that is necessary is to gain command of the air and then bomb these two fountainheads out of existence. Land forces, sea forces, and even antiaircraft defenses, whether mobile or static, meant nothing to Douhet, because *"National defense can be assured only by an independent air force of adequate power."*

His error was Bloch's in reverse. Whereas Bloch saw total stalemate through firepower, Douhet saw total annihilation. Both overlooked the supreme fact that the sole thing impossible in war is for it to stand still; that directly a weapon approaches or enters the master stage, the constant tactical factor comes into play—that is, every improvement in armament is eventually met by a counterimprovement which gradually or rapidly whittles down its power. Were this not true, war would have come to a Blochian or Douhetian conclusion in the Stone Age or before. The secret which Douhet could not grasp was that inventive genius when stirred by the instinct of self-preservation knows no bounds. He was a wonderful salesman and, like many such people, a prophet of the ridiculous.

Though in the welding of civilizations the airplane is playing a great part, in range and speed of "striking power" it is vastly inferior to the radio, the reach of which is global and the volume of its striking power "atomic." Without exaggeration, it may be said that today the radio provides us with an inexhaustible supply of mental food which, like the manna of Exodus, is for immediate consumption. Whereas print can attack the literate only, the radio attacks literate and illiterate alike.

As among the vanquished war was the uppermost thought, by means of the radio the nation in arms was transmuted into the total state. Whereas among the victors, who anathematized war, it was used to propagate pacifism.

Meanwhile, in the years following the war, technology, advancing by leaps and bounds, led to such overwhelming production that, restricted as they were by the shortage of currency inherent in a financial system shackled to gold, the peoples of the world were unable to purchase and therefore consume the plethora of goods produced.

This lack of purchasing power resulted in world-wide unemployment which led to two tentative solutions: In the victorious countries to the "dole" system and the subsidizing of nonproduction, and in the vanquished countries to a return to conscription and the establishment of war industries, the product of which could only be consumed on the battlefield.

Thus arose two opposed conceptions of peace: On the one hand that of the New Order, the aim of which was to create economically self-sufficient blocks of nations linked together by a currency based on capacity to produce, and on the other hand that of the Old Order, whose aim was to maintain the existing status of nations, trusting that the old financial system would in some undefined way solve the economic problems which technology had created and was daily multiplying.

Thus it came about that, once again, the world was faced by an irresistible force confronting an irremovable object, and the inevitable result was the second World War, which was opened by the German invasion of Poland on September 1, 1939.

The war which now burst upon Europe, though technically and tactically less experimental than the one which preceded it, was nevertheless essentially a testing ground of theories, each of which was intimately related to armament. Of these theories six are outstanding: (1) The value as a fighting instrument of the nation in arms

as conceived by Clausewitz; (2) The value of mechanized armored forces as visualized by myself and others; (3) The value of linear defense as represented by the French Maginot Line; (4) The value of the blockade as held by the British; (5) The value of the Douhet theory of the attack on industry and the civil will; (6) The influence of air power on land and sea power.

These technical-tactical problems were set in a strategical frame, also largely theoretical, and it is important to have a clear conception of it before the six problems are examined.

Not only for statesmen and soldiers, but also for history, it is tragic that Clausewitz did not live to complete his philosophy of war. Had he done so, there can be little doubt that his claim—that the military aim of war is the annihilation of the enemy's fighting forces—would have been modified by his belief that at times the goal should be more limited. Of his many students, Delbrück was the first to point this out in his "Geschichte der Kriegskunst"—that as there were two forms of war, limited and unlimited, it follows that there must be two forms of strategy. These he called the strategy of annihilation *(Niederwerfungsstrategie)* and the strategy of exhaustion *(Ermattungsstrategie)*. Whereas in the first, the aim is the decisive battle, in the second, battle is but one of several means, such as maneuver and economic attack, whereby the political end is attained.

WERE Clausewitz and Delbrück alive today, both, I think, would see that in the present technological age the strategy of annihilation demands not so much the destruction of the enemy's army as the destruction or occupation of his vital area of operations—that part of his country essential to the maintenance of his forces in the field—his coal fields, oil wells, industries, etc. Therefore, should it be sufficiently shallow to permit the momentum of a mechanized attack being maintained without break across it, its occupation will prove even more decisive than the enemy's defeat in the field, for without it his armed forces cannot for long exist.

This shallowness was to be found both in Poland and France, whereas in Russia it was not, for there the vital area stretched from the river Bug deep into Caucasia and far beyond the Urals. Therefore the German strategy of annihilation which succeeded in France failed in Russia because the condition of depth demanded the strategy of exhaustion.

BETWEEN the poles of this dual strategy revolved the main events of the war, and to their six major problems I will now return.

1. *The value of the nation in arms.*—This order of power was not only extended, but also vastly modified. On account of ever-increasing industrial demands, the conscription of labor, including women as well as men, was introduced even in the democratic countries. On account of the constant threat of air attack, an unarmed *levée en masse* was made of civil air defense workers—fire watchers, fire brigades, demolition squads, police, ambulance units, etc. And on account of the danger of air-borne invasion, militias were raised, such as the British Home Guard and the German Volkssturm.

But in offensive value the nation in arms declined, for though in battle infantry still played a notable part, the striking power of armored troops, of artillery, and of aircraft, was the dominant offensive factor. Otherwise put, fighting power was derived from the machine arms far more so than the hand arms; from technology and quality rather than from quantity and man power.

2. *The value of mechanized forces.*—Though in Poland, France, and North Africa armored forces more than justified the expectations of their adherents, in Russia, and especially so during the 1941-1942 campaigns, they did not. Great distances and vast spaces played their part; but, in my opinion, the main reason for this was that as all their auxiliary arms and services were transported in wheeled vehicles, armored divisions were almost as roadbound as the nonmechanized forces. Had the German armored divisions in 1941 not been strangled by their wheeled vehicles, there can be little doubt that Moscow would have fallen that year. Had it done so, the hub would have been knocked out of the Russian railway system and the whole course of the war changed. All belligerents committed the error of coupling wheel and track.

3. *The value of linear defense.*—Though in armored warfare all field defenses should be mobile—that is, transportable—as in a rudimentary way many of the German "hedgehogs" were in Russia and the British "boxes" in North Africa, permanent fortifications, if built from an antitank and antiaircraft point of view, are as essential to tank forces as once were castles to armored knights. Even the much-abused Maginot Line could have been turned into a formidable barrier—not by continuing it from Longwy to the sea, but by assembling on its left flank a powerful armored force to act to it as sword to shield.

4. *The value of sea blockade.*—Blockade by sea power reaches its maximum effect when defensive warfare predominates on land; that is, when the enemy's land forces are denied liberty of movement, as they were throughout the greater part of World War I. Conversely, its value falls in proportion as land warfare becomes mobile, either because the enemy is rapidly defeated on land, when blockade becomes useless, or because by vanquishing his opponents and occupying their countries the enemy increases his food and supply area. This was the case in the present war. Further, the advances made in the production of synthetic substances has gone far to blunt the edge of blockade. The most remarkable example is synthetic oil, without which the Germans could not have declared war, let alone wage it.

5. *The value of the Douhet theory.*—As might have been foreseen but unfortunately was not, air attack on the enemy industrial centers and on his civil population, as advocated by Douhet and others, proved the greatest military fiasco of the war. Not that immense damage was not done, for it was—damage, human and cultural,

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which completely puts to the blush the destruction wrought by Goth, Vandal, Lombard, and Hun. But instead of annihilating the enemy's industries, it scattered them, and instead of forcing his civil population to revolt, it stimulated their will to fight. To have proved effective, air attack should have been directed against the sources of industrial power and not against the industries themselves. Had the German coal fields and synthetic oil plants been kept under constant bombardment, in time all the German heavy industries would have had to close down.

6. *The influence of air power on land and sea power.*—When used as an independent weapon, the tactics of the air assault were as brutally simple as those of the old cavalry charge and on occasion were as overwhelming—as in the great attack on Hamburg in July 1943. Nevertheless, as cavalry only attained its full effect when combined with infantry, and later on with artillery, so did aircraft only attain theirs when combined with armies and fleets. Whenever this was done on land, as notably in the German invasion of France in 1940, in the British campaign of El Alamein in 1942-1943, and in the allied invasion of Normandy in 1944, integration of air and land power proved overwhelming.

Similarly at sea, for though on occasion independent aircraft gained spectacular victories, as in the sinking of the PRINCE OF WALES and the REPULSE in December 1941, it was in integrated battles, such as those of the Coral Sea and Midway Island in 1942 and in the great battles of the Philippine Sea in 1944, that their fullest effect is seen.

In 1937 I wrote on this subject: "It seems to me that a radical change will have to take place in our idea of the capital ship, around which present battle tactics revolve. In my opinion, she will no longer be a gun-ship but a bomb-ship. In other words, our present aircraft carriers, which are looked upon as adjuncts to battleships, will, in more efficient form, replace them as the master ships of our fleet, and all other ships—cruisers, destroyers, submarines, and possibly also battleships—will become their auxiliaries, the moving sea fortress from which their aircraft will operate. . . . Bomb power is the key, because air-carried bombs vastly outrange gun-fired shells. As this is so, it follows that naval warfare will be very different from what it was in 1914-1918" ("Towards Armageddon," p. 196).

Further, when the airplane was used as a carrier as well as a long-range gun, the revolution in tactics was complete. This is clearly seen in the air-borne attack on Norway and Crete in 1940, in Wingate's campaign in Burma in 1944, in the invasion of Normandy, and in the battle of Nijmegen-Arnhem which followed it.

THE revolution following World War I was complete. Politically, it destroyed three empires—the German, Russian, and Austrian. Economically and financially it ruined the defeated nations, and, with the exception of the United States, it bled white the victorious.

THESE various theories, as well as the normal demands of war, backed as they were by industry and technology, led to a progress in armament so all-embracing that many years will be needed to codify and digest it.

Since 1939, new weapons, as well as new means of waging war, such as radio location, direction, and control, have literally poured onto the battlefields. Innumerable improvements have been made in aircraft and in antiaircraft devices, in submarine and antisubmarine warfare, and in armored vehicles and antitank weapons.

A few of these improvements are: Flail tanks for exploding mines; saw tanks for cutting paths through woods; recovery tanks for hauling vehicles out of deep water; flame-projector tanks of great power; engineer tanks armed with a heavy mortar and equipped to carry and place in position carpets of flexible tracks to enable following vehicles to cross breaches, sand dunes, and marshes; the American Locust tank for air-borne troops; and such allied instruments as various types of bulldozers and the American "Water Weasel," a sort of amphibious jeep.

Of these many inventions, probably the most radical, revolutionary, and portentous are those of the German flying bomb and war rocket, because both, and more particularly the second, promise an ever-increasing range of action, until striking power may actually become global. Further, both cut the human element in war down to its irreducible minimum, an achievement hastened by aircraft and tanks. As one writer has put it, the portent is "blind annihilation at an ever-lengthening range." (The German flying bomb, V1, was a jet-propelled flying torpedo with a warhead of approximately 1,000 kg., gyro-controlled and driven by petrol of which 180 gallons were carried. The range of the first model was about 150 miles; speed, approximately 400 miles an hour.)

The first time I wrote on this type of warfare was in the London *Radio Times* of July 6, 1928. I amplified it in my book "The Dragon's Teeth," published in 1932, and in *Action* of October 19, 1939, I wrote an article entitled "Hitler's New Weapon: Rockets in War" in which I said: "Therefore, I suggest it is possible that in this present war, and highly probable should it be a long one, we shall see cities bombarded by rockets. . . . Also . . . as a stepping stone to this war of annihilation, aircraft will be fitted with rocket bombs. . . ."

It is strange that the rocket, now the newest, is yet probably the oldest of all explosively propelled projectiles, for it is supposed to have been first used by the Chinese against the Tartars in 1232. Anyhow, it is known to have been employed by Timur in his great battle of Delhi in 1399, and it was the Indian rocket used by Tipu Sultan at the siege of Seringapatam in 1799 which the British gunnery expert, Col. William Congreve, took as his model and improved upon. He informs us that he "made rockets of from two ounces"; "a species of self-motive musket ball" to three hundredweights. In 1806 they were first tested out at the siege of Boulogne, when, as Congreve writes, "In less than ten minutes after the first discharge the town was discovered to be on fire." Of this weapon he predicted: "The rocket is, in truth, an arm by which the whole system of military tactics is destined to be changed."

This prediction is one of the most remarkable in military history, for though as a weapon the rocket was abandoned by the British armies in 1885, and by all Continental armies still earlier, today the prophecy is being fulfilled by this weapon in three separate forms: as a short-range projectile, as a long-range projectile, and as a propulsion engine.

As the first, it is being used in the air, on land, and at sea. It is used by aircraft, such as the British Typhoon, because high projectile power can be

gained without the use of a heavy cannon. On land, the short-range rocket has taken a large number of forms such as the American bazooka rocket gun, the Russian multiple rocket thrower called "Katyusha," and the German Nebelwerfer—a 6-barreled weapon which fires six 55-pound rockets to a range of six thousand yards.

As a naval weapon, its importance is now fully recognized. It proved so successful in the Pacific waters that, on December 13, 1944, the U. S. Navy Department announced that rocket production was to be increased by 300 per cent. In these operations, rocket-equipped landing craft formed the spearhead of nearly every invasion, and we read that, as a covering weapon, it has become "a vital factor in landing on enemy-held beaches."

SO far, as a long-range projectile, the rocket has been used solely by the Germans. Though a cumbersome weapon, some 46 feet in length and weighing between 12 and 15 tons (see ARMY ORDNANCE for March-April 1945, p. 236), considering that it is still in a purely experimental stage, at ranges of 200 miles and under it has proved itself to be a formidable weapon which, should a less bulky propellant than alcohol and liquid oxygen be discovered, will, as Congreve foresaw, entirely revolutionize tactics.

Also, when used as a propulsion engine, the possibilities of the rocket are as great. As certain types of fighter planes are already propelled by rockets at speeds exceeding 600 miles an hour before the present century has run its course, there is nothing fantastic in suggesting that complete armies will be transported through space hundreds of miles above the earth's surface to speed toward their enemy at thousands of miles an hour.

Unlike a shell, the rocket needs no explosive force behind it and, unlike the flying bomb, no atmosphere against which to push. In fact it attains its highest efficiency when moving in a vacuum. This was Ziolkowsky's great discovery in 1903. The reason is that it acts by reaction in accordance with Newton's third law of motion—"To every action there is an equal and contrary reaction." This may be explained as follows: Place a machine gun on a frozen lake. Fire one round, and the gun will jump back a certain distance. Next, fire a succession of rounds, so that the recoil of each shot fired boosts on the recoil of the last shot fired. In a few seconds, recoil accelerating recoil will send the gun racing backward over the ice. Lastly, imagine all friction with the ice removed and you have a simple picture of how a rocket works.

Indeed, we live in extraordinary times, in days of strange and violent possibilities. Daily, war is becoming even more of a struggle between inventors than between soldiers. So much is this so that the highest inventive genius must be sought, not so much among those who invent new weapons, as among those who devise new fighting organizations—who, by shaping all instruments of war, old and new, around the dominant weapons, invent new fleets and new armies.

An outstanding example of the rational form of inventiveness is the Normandy invasion of June 1944. What was the problem? Not merely to cross the English Channel but to cross it on a wide front in deployed fighting order; land a highly motorized army, its equipment, and stores with the utmost speed; and on landing supply it with the utmost rapidity.

In the past the major difficulties were: (1) That there could be no deployment in order of attack, because the vessels used reduced the troops to passenger freight, which could only assume a tactical order after landing; (2) Before this change-over from a tripper to a fighting footing could be effected, a transshipment from transports to lighters had to be made in order to span the gap between ship and shore—this was the crucial subproblem; (3) That unless a well-found port was immediately occupied, the invading forces could not be adequately supplied. In brief, in face of an alert enemy, protected by powerful coastal defenses, an overseas invasion was not a practical operation of war.

ALL these problems were solved by inventions their difficulties suggested. The three outstanding were: (1) The construction of special landing craft which enabled the sea passage to be made in tactical order. (2) The waterproofing of vehicles—combat and administrative—in such a way that, under their own power, they could span the sea gap between landing craft and shore. (3) The prefabrication of a transportable port of disembarkation.

In the Pacific theater an even more intricate inventiveness is to be seen, and as there the problem of invasion is a threefold one—to maintain command of the sea, to gain command of the land, and to supply vast numbers of vessels, machines, and men—the instrument is also a threefold one. It consists of a battle fleet, a floating army, and a floating base. The first is organized around the aircraft carrier—its outfighting arm—and also comprises light coastal vessels, either towed or carried on parent ships, for island fighting—its infighting arm.

OF the new weapons of war probably the most radical, revolutionary, and portentous are those of the German flying bomb and war rocket, because both, and more particularly the second, promise an ever-increasing range of action, until striking power may actually become global. Further, both cut the human element in war down to its irreducible minimum, an achievement hastened by aircraft and tanks. As one writer has put it, the portent is "blind annihilation at an ever-lengthening range."

THE floating army consists of a vast number of transports and special landing craft and the floating base of various vessels, many of which have never before been seen at sea. Among them are to be found escort aircraft carriers, aircraft tenders, and repair ships—floating workshops which take the place of shore dockyards—minesweepers, supply ships, oilers, ammunition ships, water ships, store ships, food ships, hospital ships, salvage ships, and recreation ships.

This vast instrument, an integration of air, sea, and land power, is a creation rather than an invention. Like a great city, it is the product of innumerable brains and hands, and it requires a vast staff of technicians, engineers, mechanics, and craftsmen to maintain it. In it armament has all but completely grown out of the tool stage and has entered its machine life—a weapon of a million parts working as one and vivified by oil.

EDITOR'S NOTE.—General Fuller's series of articles on armament and world history will be concluded in the July-August issue of ARMY ORDNANCE. They will then be published as a book entitled "Armament and History" by Charles Scribners' Sons, New York.

Peace or Pacifism?

America Cannot at the Same Time Be Rich, Weak, and Safe

Col. John G. Booton

I AM unable to tell you exactly what kind or how much of an army we may need in the years after the present war. Neither can any one else. It will depend on our success in putting together a badly scrambled world. It may be set up so that the members of a considerable group are tempted to disdain what can be enjoyed from peaceful effort and to covet that which can be taken only by force. They will soon be following a leader ready to challenge the peace of the world for the plunder that he can promise. Such a challenge can be discouraged or defeated only by ample and ready military force.

While Gen. George Washington was considering the military policies of our new country he proposed an army that would make us "respectable in the eyes of our friends" and "formidable to those who would otherwise become our enemies." Whether such defenses and a determination to keep the peace of the world would have avoided the last two wars, we will never know.

But we do know that we have listened to those who urged that a passive will toward peace would keep us out of war, and it has forced us unavoidably and inevitably into both of them. The waste of each has been far more than the cost of planned defenses, ready in time to meet such a threat to our peace. Either of the wars might have been avoided had we been more diligent in seeing and meeting the rising threat to the free governments. Clemenceau is quoted as saying, from the wealth of his long experience, that "no peace is possible without force."

In a treatise written in 1783 General Washington said: "It may be laid down as a primary position and the basis of our system that every citizen who enjoys the protection of free government owes not only a portion of his property but even of his personal services to the defense of it." He proposed that all young Americans should have military training in their nineteenth summer and again in their twentieth and twenty-first summers and that during these years all citizen soldiers were to be enrolled in local units of the "advanced corps" of the National Citizens' Army. They would thus be held in readiness for a call to arms if they should be needed.

Along with this he proposed enough Regular officers and soldiers for administration of the Army, teachers in the military schools, guards for the national arsenals, and troops to garrison posts on the Indian frontier. He attached great importance to trained leadership. In his treatise of 1783 he proposed the establishment of "one or more" military academies. A year later he endorsed General Steuben's proposal that there should be three such academies—one in New England, one in the Middle States, and one south of the Potomac—this when our entire population was less than 4,000,000.

It is needless to tell you that General Washington's plans were never made effective. They were defeated by leaders of public opinion who urged that our Government might some day be tempted to use its power in ways which they and their followers might not like. Our peacetime military power has always been impotent either for war or for peace and has been made so at the behest of those more concerned with their plans for weakening their country than with any plan for its effective protection.

As this war draws to a close, we must again consider whether we shall adopt a military system that is an effective instrument of peace and order, or follow the counsels of those who distrust our Government or are the agents or dupes of those who may plan its destruction. It is for you to consider what kind of an army you want and how it should be run. It is your Army, created under your direction and operated under rules made by the Congress which you elect. You should know what you want and how you wish it to be done.

Before you can object that this is a very complicated subject and one that you cannot readily master, may I ask how you can expect your elected representatives to do something that is satisfactory to you until you and they are clear as to what you want done. That is true in all matters in which they represent you, but it is particularly true as to those which so vitally affect our future peace. It is your Army which, under the Constitution, the Congress is empowered to raise and support. It is your Army which must be trained and equipped to meet the threat of military force against our country. It is your Army made up of your families, your friends, and your neighbors that must defeat any attempt by military force to disrupt our country or its ways of living. It is their blood, their sweat, and their tears that are the needless sacrifice when adequate defenses have not been provided.

"As this war draws to a close, we must again consider whether we shall adopt a military system that is an effective instrument of peace and order, or follow the counsels of those who distrust our Government or are the agents or dupes of those who may plan its destruction."

WHEN war comes upon us and what we have provided to meet it is too little and too late, it is the fashion to point the finger at the professional Army and Navy for their neglect of our defenses. They can justly point back and say that they have done all that they were permitted in preparation for the war that was threatening. They can justly say that our people have planned it that way, whether they meant to or not.

It is the people's Army. It is the people's war. It is their husbands and brothers and sons and neighbors who must be risked in combat. It is for the people to choose the plans under which our forces are to be trained and equipped and led, and to see that those plans are made effective. If this is not

Colonel Booton is assigned to duty with the Eastern Defense Command, Governors Island, N. Y.

done, who do you think will have signed the warrants for death or imprisonment of those who must be sent into battle against hopeless odds to gain time for the preparations that should have been made long before? What do you suppose the men left on Bataan thought about it? What do *you* think about it?

THIS may not be a pleasant picture, but it is the one faced by every professional soldier from the time he raises his right hand to give up all his rights under the Constitution except the one that the Congress shall make rules for the government of the land and naval forces. From that moment he must trust that the people, for whom the Congress acts, will never let him down, never place him in a position that is beyond the help they will give him to meet it.

Even if he should be sure that such a situation is approaching, he may not even raise his voice in warning unless it should be desired and approved by the Congress. That is perhaps why General Washington wanted a large part of our potential military forces to be so close to the people. They could then speak directly to the people when the danger of war became pressing. May I ask you to join with your fellow citizens of the Regular services in giving serious thought to the guarantee of peace promised by such a plan.

As an example of matters which should have been better understood, you may recall the furor about the "merchants-of-death" companies producing or able to produce military equipment and alleged to be interested in fomenting war. The leaders in this instigation, generally proponents of disarmament—for our country—were undoubtedly well aware that they were moving to hamper or destroy potential armament production that might soon be urgently needed for defense of the democracies.

They were joined of course by that part of the lunatic fringe to which any blow at our institutions or industries would be a matter of satisfaction. The purpose and effect of the effort were well understood by those in the military service who were fostering industrial preparedness for war as our Nation's strongest guaranty of peace. The matter was so managed, however, that their views were not permitted to be heard by our people. The result was the law now designated sarcastically in the press as "the so-called Neutrality Act."

When the war clouds finally broke over the democracies, it was necessary to circumvent the Neutrality Act and develop our aid to those bearing the burden of defense of the free people under the Lend-Lease plan. May I again remind you that whether we meant to or not, we were led to plan it that way by groups who intended to cripple any positive action toward keeping the peace.

I have a copy of the pertinent part of a letter written by an engineer in the Orient about 1930. In it he gave in detail the circumstances under which the Japanese nation was being delivered into the hands of its militarists and what could be expected as a result. This extract was passed around among the staff of the Hawaiian Division, with which I was then serving. We were in agreement that the situation, as he described it, was correct and must inevitably result in the attacks by Japan which he predicted. But there was nothing that we could do about it. Had we tried, we would at once have been named by the professional pacifists as warmongers and saber rattlers and, at their behest, silenced by the Government. Since that time, the attacks have been made almost exactly as they were predicted.

As we approach a serious consideration of the defenses that we should have after the end of this war, we will be set upon by a variety of groups, each wrapped in the mantle of holiness, who will shudder with horror that we should even think of maintaining the forces they designate as "hired murderers" to protect our country and the peace. They will hope that we have forgotten their influence in weakening the country until our present enemies thought it safe to challenge us. They will hope that we have forgotten the needless costs in lives and money brought upon us by having too little and being too late.

When they go into action, we must remember that there are among us on the ship of state fellow travelers who would cheerfully wreck it for the throats they could cut and the purses they could slit after it was on the rocks. They look upon any organized force that could be used to suppress the confusion they desire as against their version of the public interest. Along with them we will find the usual collection of long-haired men and short-haired women who enjoy the public notice brought about by their "being different."

Subversive or revolutionary movements that must rely on the military weakness of our country for the success of their plans to seize the Government will be well represented. And there will doubtless be agents of any foreign group or government that may see future benefits in reducing the size and efficiency of our Army and Navy. In the past, some of the best and most effective items of disarmament propaganda have been obvious translations of arguments prepared in a foreign language.

DIRECTING this splendid group of patriots will generally be professional organizers who coin the slogans, select the lies, and arrange the half-truths that are its stock in trade. They will warm over the old chestnut about seventy-eight cents out of every dollar collected by the Government being spent for wars—past, present, and future. But they will neglect to tell you what a great part is spent in paying for past unpreparedness and how little to maintain current defenses.

They will try to keep before us a vision of the white crosses, row on row, that will be left behind by our troops in so many parts of the globe, but will never tell you how much they did toward placing them there. While they are splashing the crosses with crocodile tears over the poor mother who didn't raise her boy to be a soldier, they will be fingering, under their cloak of sympathy and grief, the dagger with which they have stabbed in the back so many of our best and bravest.

Make sure that you can recognize the poisons and narcotics that they peddle and be not deceived by what they are claimed to cure. We can, if we are not thoughtful or diligent, again let them weaken us until we are unable to insist that the peace of the world be kept. Or we can insist with Benedict Crowell that our country cannot at the same time be rich, weak, and safe; and with General Washington that we shall have military forces which will make us "respectable in the eyes of our friends" and "formidable to those who would otherwise become our enemies."

Can the Reserve Corps Survive?

Some Plain Talk on a Serious Personnel Problem

Col. Crosby Field

The author believes that if the Officers' Reserve Corps is to remain effective after the present war and be prepared to render useful service in the event of another emergency, certain policies and procedures now existing should be altered or abolished. The problem is an important one, well worthy of serious thought by all those interested in the future security of America.

IT seems to be a generally accepted opinion that the Officers' Reserve Corps has been of great service during the present war, particularly at the beginning. Many military minds agree that when the next war comes we may not have at our disposal the months which we had at the beginning of the present one to tool up our plants and train our Army. In such an event the Officers' Reserve Corps should be of even greater value.

To make certain that the Reserve Corps survives during the long peacetime period between this war and the next, and that it remain in constant readiness to fulfill its prime function when called upon in the next emergency, certain abuses encountered in its use in both World Wars should be corrected. The time to plan cures for unsatisfactory conditions is now when the circumstances are fresh in mind.

This presentation is not based on any personal grievance. It is an endeavor to have corrected, if possible, a general unsatisfactory condition affecting many Reserve officers, especially those who have had long experience in the Reserve Corps. These men helped to develop it and generally aided the Regular Army officers in that long period when the public was not interested in military affairs.

The writer himself has had more than a quarter-century of service as a Reserve officer, during which time he recruited many others for Reserve work and substantially contributed to the work of Ordnance district building. In this work he assured many of his prospects that the objections which arose from their experience in the past war would not recur. Nevertheless, the same difficulties have arisen. Unless some method of foregoing these unnecessary hardships on Reserve officers is overcome in times of peace, no one in good conscience can ask top-notch civilians to join the Officers' Reserve Corps. Unless men can be prevailed upon to join the Officers' Reserve Corps, there can be no Reserve Corps. Unless service can be made attractive to top-notch men, top-notch men will not join, and the Corps will become mediocre.

The author was requested by some high-ranking Regular Army officers to put his findings in print with an idea that such presentation could be expanded by the written experiences and suggestions of other Reserve officers. That is the sole reason for the appearance of this short summary.

THE following discussion is limited entirely to officers in service forces, particularly those who are doing the same type of work while in uniform that they formerly did as civilians. The conclusions arrived at may be totally erroneous for combat troops where the type of work and leadership may be quite different from that of civilian life. As an example, the placing of a $3,000-a-year civilian over a $20,000-a-year civilian may be justified in the field if the former has displayed qualities of leadership. On the other hand, where the type of duty has been the same as in civilian life, the civilian salary rank afforded the latter can hardly be disregarded as a mark of capacity. Unfortunately this does happen.

It is noted that for any one suggested cure given there may be other and more effective cures. The obtaining of alternate and better ones is a prime reason for publishing this summary. The reader is requested to forward his suggestions. (ED. NOTE.—ARMY ORDNANCE will welcome constructive suggestions.)

Again one of the suggested cures for a specific objection may have a great influence in the other objections. For example, the age cure suggested below will help in the other cases. It alone will not cure the numerous instances where the senior in rank is less able, but it will prevent that difference growing very great, which it would be inclined to do were the officers continued past the age of forty. Ordinary methods of review for promotion will normally take care of that disparity in grade and capacity among younger officers but cannot among senior officers who are approaching the promotion ceiling.

Ability of Reserve Officers.—There are all degrees of capacity represented among officers on active duty, and unfortunately the senior in rank is frequently the less able. Too, we find large numbers of commissioned civilians who have never held a Reserve commission and who have ranks relatively high in comparison with Reserve officers of probably the same ability.

It is suggested that, at the age of 40, all Reserve officers be automatically transferred to the Inactive Reserve. They still would be available but their call would be improbable. By the time a man has reached the age of 40 he should have achieved a place in industry from which his departure would create a disruption in the war effort or even in ordinary civilian nonwar effort far out of proportion to his worth as an Army officer. If he has not achieved such a position in civilian life by that age, the chances are he is not of sufficient capacity to be fully representative of the grade he has obtained in the Army. In either case, I believe only the most exceptional circumstances should require the utilization of an officer over 40.

Promotion.—Reserve officers who have assiduously applied themselves to Reserve work during the peace interval have been mercilessly stepped over by civilians with little or no peacetime Reserve experience. The service owes a

Colonel Field, a well-known industrial engineer and distinguished Ordnance Reserve officer of World Wars I and II, devoted the intervening years, 1918-1941, to intensive activity for the Corps. He is now on active duty as deputy chief of the Ordnance Safety and Security Division, Chicago, Ill.

great deal to these "Johnny-come-lates," and there is no doubt that in many cases they have had high ability. Why, however, should anybody with high ability tie himself up in a one-sided contract with the Government, such as the Reserve officer assumes, if men with ability are always available and able to step into proper positions when needed? If this be the case, then the recruiting officer will have to tell his prospects "Be patriotic, stay out of the Reserves, then when the emergency arises you will be able to assist the Government in putting you into a position where you can be of real use. If no such position is available then you can continue to be of service to the country in your civilian work and not be automatically forced into a position of comparatively little responsibility."

There is no incentive to the man of ability holding a responsible position in civilian life to continue his Reserve commission in order to enter active service in the type of subordinate position to which most have been called during the present emergency. He has full knowledge, furthermore, that his peer or subordinate in civilian life may enter directly without previous Reserve commission and with equal or even higher rank.

It is suggested that the grade of brigadier general be made available to a reasonable number of Reserve officers or permit no Reserve officers who are not in the Inactive Reserve to continue to hold a rank higher than lieutenant colonel. Each officer serving his country well can then be sure of at least one promotion in grade during his period of active service. An officer on inactive status deserving promotion to colonel should be placed on the Inactive Reserve, as the chance of his receiving a job while on active service commensurate with that grade is remote.

Assignment.—Very few Reserve officers are fulfilling the duties for which they were trained during peacetime but instead have been sent into new work. Of course, we understand that the fluidity of war requires much more help in one type of work at one time than at another, but very frequently these changes in assignment are made because of other and by no means compelling reasons. For example, many officers were trained for duty in district offices but were precluded from entering into service there because of the nearness of their homes to the headquarters—the very reason they were assigned originally to that district. Again, other officers were prevented from seeing service for which they were trained because the tables of organization for the district were revised downward with no provision for their being called in the grade which they then held.

It is suggested that a basic change in the concept of the status of the older Reserve officer be made. He is ever the civilian specialist in uniform; he can never be a Regular Army officer because of the deficiency in all-around training required for an officer of equal rank. Why, therefore, should he in active service be subject to all the disadvantages of the service of a Regular officer and yet never be on a parity when the benefits are considered? He is essentially a specialist and, when there is no need for his specialty, he should be returned to his inactive service and civilian life, once the job for which he is trained and had been called has been fulfilled or when it becomes apparent promotion is not in line for him.

Responsibility.—Several of the services have come to the conclusion that no major division shall be headed by a Reserve officer. As a result, we have many Regular Army officers now in charge of divisions with Reserve officers assisting them fully competent to take over, in certain cases with superior all-around knowledge and experience.

Suggested cure: Either arrange for a Reserve officer to head these divisions after he has served a sufficient apprenticeship in a subordinate position or permit him to return to private life after he has served his primary purpose in getting the organization started and in operation.

Awards and Decorations.—In the theaters of operation, a Reserve officer has no opportunity for recognition by award unless his assignment is changed or he returns to private life. An officer who has been successful in an assignment is normally maintained in that assignment and is therefore automatically precluded from receiving recognition, whereas the man who spends a short time doing a reasonable job but changes his job frequently is in line for an award.

It is suggested that all Reserve officers who have distinguished themselves be returned either to civilian life or to another assignment after they have been more than eighteen months in any one assignment, or else change the present rules for the granting of awards.

The general peacetime upgrading of capacity among Reserve officers can be accomplished by requiring the local examining boards to be more severe and by subjecting their findings to review. This can be accomplished, however, only if there are enough incentives to draw upon the better class of technical men.

At least one Ordnance district has permitted several men to receive commissions and even to receive promotion simply because they were needed and no one of higher capacity could be found who would accept a commission. Such situations are going to be accentuated after the war.

No attempt is made herein to suggest rewards for Reserve officers in active service in this war. That is a matter to be considered in other ways and at other times. This is only a consideration for the future as seen by a Reserve officer who has watched the Reserve Corps grow and has assisted in its growth, and who fears these obstacles might even prevent the continuance of the Corps.

THE situation is quite fundamental. It is possible that the whole thing could be remedied by eliminating the Army Service Forces Officers' Reserve Corps and utilizing civilians much as other civilian agencies are doing. The Government has, however, obtained a large amount of devoted service over many years by many Reserve Corps officers. If it is to continue to get this type of service from able men, it must do its part and make service by these men in peacetime possible and wartime service likewise attractive to them.

It is noted that the principal motivating characteristic that has caused many Reserve officers to work diligently for many years to maintain their Reserve commissions on an inactive status is one which it is not considered in good taste to mention—that is, ordinary patriotism.

It must be admitted that extraneous motives may play a part in greater or lesser degree with all of us. But where the reduction in income is four-fifths or more and where the result is to keep a man away from professional and business development for several years, subjecting his family to what may euphemistically be termed "great inconvenience," then, if you do not believe it patriotism, the only alternative is to consider it a more or less mild degree of insanity.

ORDNANCE ROLL OF HONOR

THE following Ordnance officers have been awarded the Legion of Merit for service as outlined in the accompanying citations:

COL. WILLIAM A. CALL, Takoma Park, Md.—"For his assignment in January 1941 as the first director of training of the Ordnance Replacement Training Center, Aberdeen Proving Ground, Md. He was confronted with the difficulties of establishing a training program with very little equipment, inadequate facilities, and an extreme shortage of trained cadre personnel. Through his organizing ability, ingenuity, and improvisations, a highly successful training program was formulated and administered. . . . He was assigned in October 1942 to Camp Santa Anita, Calif., where he organized the training staff and developed a highly effective unit-training program. Later, as executive officer of the Inspection Division of the Military Plans and Training Service, Office of the Chief of Ordnance, he contributed largely to the training of Ordnance units for overseas service."

Col. W. A. Call

COL. EDWIN H. HARRISON, Bloomington, Ind.—"For services from June 1940 to September 1942, while charged with the administration of the Arms and Ammunition Division, Proving Center, Aberdeen Proving Ground, Md., he not only demonstrated exceptional ability in administration and leadership but by personal interest contributed markedly to the progress of development of various new light machine guns, light rifles, and many items of equipment used in the proofing of small arms, light cannon, and armor plate. . . . By his resourcefulness, ingenuity, and sound planning under the trying conditions resulting from rapid expansion of the Army, he managed to meet efficiently every demand which affected his activities. By his personal example and untiring effort he inspired his subordinates to their utmost and maintained exceptionally high morale in his units."

Col. E. H. Harrison

MAJ. STANLEY J. GOOD, Fox Chase, Pa.—"For service in organizing and directing a training program at Frankford Arsenal, Philadelphia, from April 1942 to February 1944. . . . As director of civilian personnel, he organized, under severe limitations of personnel, a civilian-personnel branch at Frankford Arsenal and established an efficient system of procedures for administration of all matters affecting the relations of arsenal workers and their management."

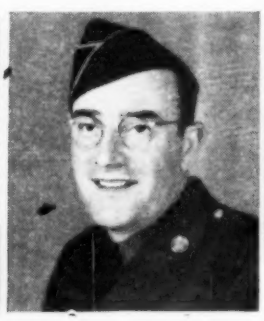
THE following Ordnance officers and enlisted men have been awarded the Bronze Star for service as outlined in the accompanying citations:

LIEUT. COL. ALFRED G. GARR, Charlotte, N. C.—"As commanding officer of an Ordnance battalion of the United States First Army, Colonel Garr received the award for preventing the capture of ammunition and equipment by organizing the defense and evacuation of the matériel during the German counteroffensive. He also efficiently established railheads for the continuous supply of ammunition to combat units."

LIEUT. COL. HENRY J. WYLIE, San Angelo, Tex.—"For meritorious services in support of combat operations of the Fifth Army in Italy. As commanding officer of an Ordnance battalion, Colonel Wylie, by his efficient preparation, organization, and coördination of the movement of fourth-echelon heavy-maintenance companies, contributed materially to the success of the Fifth Army Ordnance maintenance effort. . . . He hired a large number of civilian laborers and utilized local resources in civilian machine shops which were put into operation immediately upon arrival of the first company detachments in a new area. Uninterrupted Ordnance service was maintained."

MAJ. EUGENE P. LAYBOURNE (then Capt.), Windsor, Colo.—"For meritorious service during the month of May 1942 in the India-Burma theater."

Maj. S. J. Good



Tech. Sgt. Erwin Storz

M. Sgt. Pete Lechminek

Lieut. Col. H. J. Wylie

Lieut. Col. A. G. Garr

S. Sgt. J. G. Mussall

Sgt. R. P. Carberry

Tech. Sgt. E. A. Nelson

1st Lieut. J. D. Leonard

M. Sgt. J. G. Knightly

2ND LIEUT. JOSEPH J. BEAMAN (then M. Sgt.), Giddings, Tex.—"For performance of meritorious services in the South Pacific area from August 10, 1942, to February 4, 1944."

M. SGT. PETE LECHMINEK, McKees Rocks, Pa.—"For meritorious services in support of combat operations. Serving with the Fifth Army in Italy, Sergeant Lechminek, as shop foreman of an Ordnance unit, directed the maintenance functions necessary for servicing antiaircraft units, overcoming many obstacles. . . ."

TECH. SGT. ERWIN STORZ, Woodland, Calif.—"For meritorious services in support of combat operations of the Fifth Army in North Africa and Italy. In North Africa, Sergeant Storz supervised the construction of ramps, cranes, and pits used at an assembly park and directed an engineer platoon in the construction of a large shop building. . . ."

SGT. RAYMOND P. CARBERRY, Edgewood, R. I.—"For meritorious services in support of combat operations on the Fifth Army front in Italy. . . ."

CORP. GEORGE KOKORAN, Scranton, Pa.—"For services with an Ordnance maintenance battalion from February 1 to May 7, 1944, with the Fifth Army on the Anzio beachhead."

THE following Ordnance officer was a member of a unit which received a Distinguished Unit Citation as outlined below:

CAPT. HENRY G. WHALEY, Charleston, S. C.—"As Ordnance Officer of a Fifteenth Air Force Liberator group, Captain Whaley was a member of the unit cited for a particularly successful mission against the Florisdorf oil refineries at Vienna, Austria. He was responsible for the tons of bombs his group dropped on Germany. . . ."

THE following Ordnance officers and enlisted men have received Letters of Commendation in the field for services as outlined below:

1ST LIEUT. JOHN D. LEONARD, Kingston, N. Y.—"For extraordinary combat efficiency in towing to safety a truck and trailer that had been hit by enemy artillery fire . . . Lieutenant Leonard worked tirelessly and efficiently, and his efforts deserve the highest commendation and praise."

1ST LIEUT. HENRY A. UPPENDAHL, Dighton, Kans.—"For extraordinary combat efficiency in automotive repairs to a truck and trailer which had received a direct hit. Lieutenant Uppendahl and his section worked tirelessly and efficiently, and their efforts deserve the highest commendation and praise."

1ST SGT. FREDERICK J. STIBICH, East St. Louis, Ill.—"Sergeant Stibich displayed unusual qualities of leadership and administrative and organizing ability in the operations of an Ordnance depot company. . . ."

M. SGT. JOHN G. KNIGHTLY, Springfield, Mass.—"As chief of the supply section of an Ordnance battalion headquarters attached to the Fifth Army in Italy from January to September 1944, Sergeant Knightly displayed outstanding ability and industry in the supervision of his section. . . ."

TECH. SGT. EVERETT A. NELSON, North Branch, Minn.—"As chief of the automotive section of an Ordnance medium maintenance company attached to the Fifth Army in Italy, Sergeant Nelson rendered outstanding services in supervising vital repair and maintenance work for front-line troops. . . ."

S. SGT. JOHN G. MUSSALL, Buffalo, N. Y.—"As automotive electrician for his company attached to the Fifth Army in Italy, Sergeant Mussall displayed superior technical skill and ingenuity in providing Ordnance service. . . ."

S. SGT. HARRY L. SWANSON, Minneapolis, Minn.—"As motor sergeant of an Ordnance evacuation company attached to the Fifth Army in Italy, Sergeant Swanson demonstrated exceptional ability in the organization and supervision of the vehicle crews in the performance of maintenance and repairs to their wreckers and vehicles. . . ."

SGT. GUNNAR JACOBSEN, Chicago, Ill. —"As shipping clerk for his Ordnance unit attached to the Fifth Army in Italy, Sergeant Jacobsen initiated and effectively operated a system expeditiously to deliver replacements of Ordnance major items to forward units."

Capt. H. G. Whaley

Sgt. Gunnar Jacobsen

1st Sgt. F. J. Stibich

Corp. George Kokoran

1st Lieut. H. A. Uppendahl

Ordnance and World Security

We Need Weapons Research To Enforce a Lasting Peace

K. T. Keller

THE news from the theaters of war today is the most hopeful we have had since the struggle began. However, I am one of those who still believes that we have two wars to win until we have won them. Therefore, I believe the first duty of all of us, especially those engaged in making war materials, still is to see to it that our armed forces have the best weapons we can give them in both quantity and quality. We should not be diverted from that work.

Nevertheless, it is not too early to consider some of the implications of the news as it relates to our future preparedness. Our enemies are now beginning to be overwhelmed both by our fighting men and by the might of our armament. It is the end result of extraordinary Ordnance-Industry teamwork which from the beginning has made the outcome certain, however long it might take to accomplish it.

This raises the question as to whether we shall have the wisdom, the fortitude, and the determination to preserve this team as an active, effective agency working for the continuing security of the United States after the war.

Next to the immediate job of keeping up uninterrupted the flow of weapons and keeping ahead of the enemy in new weapon design, it seems to me that the members of this Ordnance-Industry team have no more important responsibility than to make sure of the affirmative answer to that question.

As far as industry's part in the war is concerned, its accomplishments have been due to several fundamental factors. These are: (1) rapid conversion to war manufacture, (2) application to war manufacture of engineered production methods developed in peacetime, (3) production in remarkably short time of an enormous output of war goods, and (4) intelligent coöperation on the part of those who design the equipment, those who manufacture it, and those who use it.

I refer specifically to the notable coöperation we have had on the part of the Ordnance Department. After they had schemed out something in consultation with the using services, they brought to us what we needed to have in order to work out the practical production angles.

These simple principles underlie the success which this country has had in its war production. They did not happen accidentally. Nor will the benefits which this country should continue to realize from them in peacetime accrue to us accidentally.

History should be so clear, especially to those of us who have now gone through two world wars, that it would seem entirely unnecessary to emphasize its lessons so far as preparedness is concerned.

The plain fact is that human nature being what it is we do get into wars. Notwithstanding the fact that the world has become smaller in time, in transportation, and in communications, international complications do arise and nations do find themselves at each other's throats.

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GERMANY'S defeat shortly seems almost certain, and perhaps sooner than we realize we shall be confronted with the actualities of postwar international relations. Only the blind, the ignorant, or the foolish would approach the task of achieving either security or prosperity in a spirit of lighthearted optimism.

The complex tangle of problems involved is almost terrifying. There is no easy path to their settlement, no swift way of healing the world's wounds. We shall have turmoil, restlessness, conflicts of interests and clashes of ideas, envy, suspicion, and disappointed hopes. War hatreds, engendered by five years of destruction on a scale the world has never seen before, will not die down as soon as the last shot has been fired.

Maybe this will be the war to end wars. I sincerely hope so both as a private citizen and as an automobile manufacturer. Wars do business no good. Industry's prosperity is peacetime activity.

"World security . . . will be based on the supremacy of the weapons of the future. And such weapons should be American weapons, the product of American industrial and military science, with their secrecy and design amply protected."

So I am neither an internationalist nor an isolationist. I am neither a pacifist nor a warmonger. I am an American. And as an American, I believe we should act in such a way as to deserve the security in which we wish to live. Unfortunately, in a democracy we are inclined to elect people to office and then think we have done our jobs as citizens. We go about our own business and pay little if any attention to what the Government is doing.

I believe that in the interest of the future security of our country it is going to be necessary for us to take a more active interest in what the Government does. It is going to be necessary to see to it that practical security measures are not neglected for the idealistic.

A sense of realism is going to be necessary in this field as it is also going to be necessary in the field of everyday economics. It is just as futile, in international matters, to rely on good intentions alone as it is to think, in economic matters, that we can improve our standard of living, or even get back to prewar standards, by promises of early prosperity—forgetting that a good authority on human nature told us long ago that man must live by the sweat of his brow.

I have had something to do with the manufacture of weapons in the two world wars in which the United States has become involved. Each one of these wars found us woefully unprepared on our own account.

In the first world conflict it was the war work for the Allies, undertaken as private contracts by American industries, which later provided our own country with the nucleus of the war industries it had to have when we be-

Mr. Keller is president of Chrysler Corporation, a national director of the Army Ordnance Association, and a member of the Association's Committee on Aims and Organization. This is an address delivered at the second meeting of the Aberdeen Proving Ground Post of the Association, Aberdeen, Md.

came involved. Otherwise we would have been in dire straits as a belligerent. Our money alone would not have been sufficient to see us through successfully.

We had not had the sense to prepare. I am not thinking of preparedness in terms of a huge army and navy. I am thinking of preparedness in terms of our keeping abreast of the know-how in weapons and weapon design and manufacture. I am thinking of preparedness in terms of practical teamwork between industry and the Army and Navy in times of peace.

WE had a similar experience in connection with this war. Instead of the private contracts of the Allies, this time it was Lend-Lease which, fortuitously, gave our industry the opportunity, and to some extent the time, to get in training to meet our own war needs.

Even after it became inevitable that we would become embroiled, the Ordnance Department of the Army was restricted to miserably small expenditures for research and development that should have been done earlier and on a much more extensive scale. Little if any encouragement was given to coördinating this development work with industry.

It was not until we were practically at war that the task was realized either by the political government or by the people. The fact that such extraordinary results have nevertheless been accomplished is due only to one thing: it is due to the way industry and Ordnance worked together to save this country from its own twice-repeated folly. Our security as a nation and our security as individual citizens should not rest on such a narrow margin of safety.

Keeping the world at peace is the most important job confronting every nation after the war has been won. We all hope that a pattern can be set that will be at variance with history. We all hope that what was begun at Dumbarton Oaks and continued at San Francisco will be such an effective pattern.

At the same time I believe our country should make sure that it never again gets into the position in which it found itself in every war in which we became engaged—totally unprepared. That is why I am so much interested in the idea we are considering today.

When World War II was forced upon us, Ordnance approached industry as a recognized partner in the development of military weapons and found industry willing to pool its own ingenuity and experience. Ordnance also inspired mutual confidence and respect in its dealings with industry and encouraged industry to assume its rightful responsibility for the success of the war program.

As a result, not only does our Army have weapons that surpass the enemy's, but our country itself has an asset it did not possess a few years ago and one upon which it should continue to realize in years ahead.

It will be just as important from the viewpoint of national security that those of us in industry and in the Army and Navy who are responsible for producing the materials that are needed in war should continue in peacetime to approach our mutual responsibilities with a continuing desire to keep abreast of our respective abilities, our limitations, and our possibilities.

In the Army Ordnance Association it seems to me we have the practical means for continuing during peacetime the pattern of coöperation that has been developed for war. Between the Army and Navy Ordnance Departments, as well as in industry, there has come about a clear recognition of our respective responsibilities. In this Association we have the means of providing the coördination that is necessary to fit those responsibilities together in a practical way for continuing security after the war has been won.

In this Association we have men in the services and men in industry who know how to design weapons and how to make them. In this Association we have the men who know how to prove weapons and who know their use.

The liaison among these groups should not be allowed to vanish. The Army and Navy have a better appreciation today of the engineering and manufacturing problems involved in the design and production of war weapons. Industry has a better appreciation than ever before of the Army's and Navy's talents in the field of weapon conception and use.

What is needed is for this team to continue to function so that industry will know what the Ordnance people have in mind, and that Ordnance will know what is necessary from an engineering and production standpoint. Secrecy need be no barrier. Industry certainly has demonstrated its patriotism in this respect.

Such is the pattern by which some of the most remarkably successful weapons of this war have been developed. Take the latest tank, the T26. Compare it with the first tank we undertook to build, and it will give you a practical demonstration of what the coöperation between industry and our military officers can accomplish.

We should continue this research and development of war machines and materials by continuing to coördinate the knowledge of our physicists and scientists and our Ordnance experts with the manufacturing skills of our engineering and production industrialists.

World security, which means our own security, cannot be based on the number of weapons we may have left over from this war. It will be based on the supremacy of the weapons of the future. And such weapons should be American weapons, the product of American industrial and military science, with their secrecy of design amply protected.

Out of this conflict, what new wonders will be developed? Take the new science of atomic physics and the possibilities indicated by the cyclotron. Here is a challenge to the imagination that calls for the best collaboration we can devise—because it involves the future protection of our country.

WILL the Army Ordnance Association dedicate itself to such research and development? Will the members from both Ordnance and industry carry on this research and development without the stimulation of an active enemy? Can we, working together, lead our American people to support and finance a continuing program of development? In the answer to these questions lies the usefulness and the greatness of the Army Ordnance Association.

Through the Army Ordnance Association, the research, the designing, the proving and perfecting of weapons, which are necessary before their manufacture in quantity can be undertaken, can be stimulated and the important necessity of this activity kept before the American people. This is the realistic approach to world security which it seems to me is important for us to take, no matter what our statesmen may devise in the form of a world security organization.

Jet-Propelled Aircraft

The Gas Turbine Has Unlocked the Door to Supersonic Speeds Aloft

• Charles L. Fay

IT has been only 2½ years since Robert M. Stanley, then chief test pilot of Bell Aircraft Corporation, made the initial flight in the Nation's first jet-propelled airplane, the P-59 Airacomet. Since then, so many forward strides have been made and such concrete advancements recorded in the development of turbo-jet engines and jet-powered aircraft that it is somewhat difficult to realize the roots of jet propulsion go back almost two thousand years.

Somewhere in history, reference is made to the aeolipile designed by Hero of Alexandria. This device consisted of a hollow ball with two jet nozzles projecting from opposite sides through which steam escaped and caused the sphere to rotate much like a mechanical lawn sprinkler. Years later, in 1680, Sir Isaac Newton constructed a carriage equipped with a steam boiler which exhausted at high velocity through a nozzle facing aft. Control was effected by regulating the steam flow, and the reaction of the high-velocity jet propelled the carriage forward.

Mr. Fay is chief of the experimental flight test section, Niagara Frontier Division, Bell Aircraft Corporation, Buffalo, N. Y.

Men continued to probe and experiment through the years, and quite naturally rocket propulsion received considerable attention from various sources. Sir William Congreve, during the Napoleonic wars, developed rocket projectiles which were the great-grandparents of the modern bazooka rocket, and, of course, rockets had been utilized in fireworks displays since the invention of gunpowder. Ziolkovsky of Russia, Esnault-Pelterie of France, and Oberth in Germany all experimented with various forms of rocket devices, but the major portion of available accurate scientific data resulted from the experiments of Prof. Robert A. Goddard. His investigations, dating from the early 1900's, were climaxed by his proof in 1919 that rockets would operate more effectively in a vacuum than in standard atmosphere.

While rockets are a form of jet propulsion, their characteristics and operation differ widely from that form of jet propulsion utilized by the gas turbine. The rocket is self-contained; that is, it carries its own combustible elements and does not depend upon the surrounding atmosphere for oxygen as do the engines of the P-59, for instance. The rocket's oxygen can be in a chemical form, like the black powder contained in an ordinary skyrocket, or in pure form, as liquid oxygen.

During the late 'thirties, and up until the time the United States entered World War II, there were reports of jet-propulsion experiments in Europe. Secundo Campani, an Italian engineer who had been engaged in research for almost a dozen years, developed a power plant for which Caproni Aircraft Company designed an aircraft. His unit employed a conventional radial engine submerged within the fuselage and driving two multibladed propellers, which acted as compressors. The compressed air was cooled by passing through a radiator and was then mixed with fuel in an annular series of combustion chambers.

The rapidly expanding mixture was ejected through a controllable-area nozzle at high velocity to provide the required forward thrust. This aircraft was flown in August 1940 on a 10-minute flight near Milan and was sufficiently encouraging so that another and larger airplane was designed and built. On November 30, 1941, Col. Mario de Bernardi, veteran Schneider Trophy ace, piloted the bigger airplane from Milan to Rome, including a landing at Pisa, and averaged 130 miles an hour.

Germany, too, was busy with jet-propelled aircraft, and it was known that the Germans had flown propellerless planes long before Ernst Udet, the famous German ace of World War I, was killed test-flying a jet-propelled plane in 1941. The first practical application of the principle of jet propulsion in aërial warfare was the flying bomb, the V1, the basic principles of which were investigated in 1918 by the U. S. Navy in coöperation with the Sperry Corporation. Two types of German jet-propelled fighters have been encountered by allied pilots for almost a year—the ME-262, a gas-turbine aircraft very similar to the P-59, and the ME-163, a rocket model powered by a single unit.

THERE is no doubt, however, that the practical jet-propulsion unit, as we now know it, was originally of British design. A young member of the RAF, Group Capt. (now Air Commodore) Frank Whittle, had made a comprehensive study of the gas turbine and in 1930 received a patent on a jet-propulsion system for aircraft. Construction

of a working model followed, and his first aircraft engine performed successfully in April 1937. Based on the test-stand results of the unit, the Gloster Aircraft Company constructed an aircraft utilizing a single Whittle power plant, and the airplane made its first flight in May 1941.

Two months later, full information about this jet engine was disclosed to the United States Army Air Forces, and immediately a request was made for an engine to be sent to this country. The story of the development of the first United States jet-propelled plane, designed and built by Bell Aircraft Company, and using two units of the Whittle type modified by the General Electric Company, is rather a familiar story. Significant, however, is the progress already made in the United States, despite the fact that this country was several years behind other leading nations in its pioneering with jet-powered aircraft.

The Airacomet was designed and built in a hurry. The plane conformed as closely to a conventional fighter as possible, within the design limitations imposed by its unique power plants. The fuselage is similar in construction to that of any other high-powered fighter aircraft, the cabin is pressurized for extended operation at high altitudes, the wings utilize laminar flow airfoils for high speed, and the high upswept empennage provides excellent control during all maneuvers. The large air intakes in the leading edges of the wings at the roots, and the nozzles of the jets at the rear of each engine, located slightly below and behind the trailing edges, are the only obvious differences noticeable in flight—plus, of course, the lack of a propeller.

The basic components of the jet-propulsion power unit as used in the P-59 are: the air intake at the front, a centrifugal compressor, combustion chamber area, a single-stage gas-turbine wheel mounted on a central rotor assembly, the exhaust cone, and the jet nozzle. When the unit is in operation, air is taken in through the nacelle entrances and is drawn into the compressor. Highly compressed, the air then enters an annular series of combustion chambers where the fuel is injected from a high-pressure system, forming a highly explosive and powerful mixture which is then ignited.

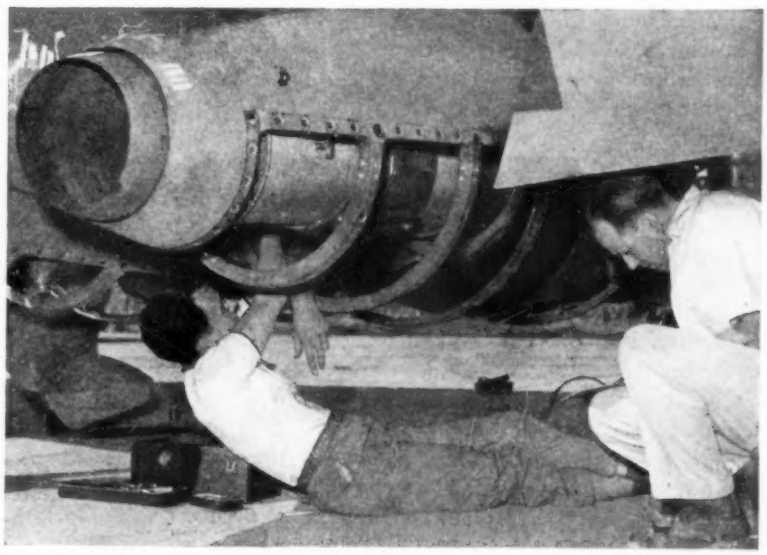
During starting, combustion is effected by a spark plug, but since the burners are all interconnected the burning is continuous after the initial firing. The gaseous mixture, as it is heated by burning, expands greatly and rushes out through the turbine at the rear of the engine at extremely high velocity. The function of the turbine wheel in this engine is to drive the air compressor at the front so that more air is constantly being compressed and put through the cycle.

The entire process is continuous and even, and the air flows out of the rear nozzle as steadily as air from an electric fan, though of course at much greater speed. Contrary to popular opinion, the forward speed of the aircraft does not result from the jet of hot gases pressing against the surrounding air but rather from the basic physical law that every action must have an equal and opposite reaction. Since the hot gases from the combustion chambers are capable of tremendous expansion, they expand to the outside atmosphere as a high-velocity jet. This jet action produces a reaction in the nature of an axial thrust on the power plant which constitutes the propelling force.

The only engine control is the throttle, which governs the amount of fuel admitted to the burners. Since the supply of fuel to the combustion chambers determines the temperature of the burning mixture, the speed of the gas-turbine wheel is controlled by varying the temperatures of these gases. With the turbine directly coupled to the compressor, increased turbine speed results in greater air flows through the compressor. Increased thrust is obtained as the jet velocity increases, and the air mass flow is increased.

THE ease of serviceability and the ease of control of the P-59 are amazing in comparison with a conventional airplane. The power units are easy to get at and work on, far less tools are required, and maintenance problems entail about one-fifth as much work. Furthermore, it also requires about one-fifth the amount of time necessary to change a jet engine as a reciprocating engine, for each engine is supported at three points in such a manner as to allow for normal expansion due to the heat of the engine, as well as rapid installation and removal.

Starting is extremely simple since all the pilot has to do is press the starting button, and there are no long or complicated servicing problems either before or after starting. Following flight, mechanics can work on the engines immediately as the absence of heavy castings allows the heat to dissipate very rapidly. Flight instruments are the same as in conventional fighter planes, but pilots are pleased by the absence of the numerous internal-combustion engine performance indicators, such as carburetor temperature, manifold pressure, etc.



First approved photograph of the interior of the turbo-jet engine.

Both in the P-59 and the P-80, the latter being the most recently announced AAF jet-powered fighter and one which carries a single jet unit, the lack of vibration comes as a very pleasant surprise to pilots flying these aircraft for the first time. This characteristic, discovered during early test flights of the P-59, was so pronounced that vibrators were installed in the instrument panels to prevent "stickiness" in the instruments.

At high altitudes and high speeds, jet-

propelled aircraft have no superior for performance, inasmuch as both the thermal efficiency of the power plant as well as the propulsive efficiency of the driving force or jet are combining to make a higher over-all efficiency than any other type of power-plant propulsion combination. At low speeds the requirements for high values of both efficiencies are incompatible in the jet system, and, therefore, there are various combinations of conventional engines and propellers which show performance advantages over the gas turbine. Below 30,000 feet and below 400 miles an hour, the conventional aircraft engine-propeller combination rates higher in over-all efficiency than the jet engine; but above 30,000 feet and at speeds in excess of 400 miles an hour at any altitude, the jet plane is much superior in all-around efficiency.

Jet engines are comparatively light in weight—much lighter than conventional reciprocating engines required for the same power—and while the rate of fuel consumption at present is high, jet engines can operate on nearly any type of hydrocarbon fuel such as gasoline, kerosene, or alcohol. Standard high-quality commercial kerosene has been used exclusively in powering the Airacomet and has the added advantages of not boiling away at high altitudes and being less inflammable from gunfire than high-octane gasoline. No warm-up of jet engines is needed, despite outside temperatures, and the P-59 can take off immediately after the engines have started.

Perhaps the greatest contribution of the jet-propelled airplane is the taming of some of the forces which have begun to prevent further development of the conventional airplane and engine. The propeller-driven airplane has given indication that it is nearing the limit of its performance. This limit is imposed by the rapid deterioration of propulsive efficiency when the effects of compressibility become apparent at extremely high speeds. The high speed does not necessarily have to be the high forward speed of the aircraft but may be the high rotational speed of the propeller. The rotating propeller tips are traveling in a circle at much greater speed than the inboard portions of the blade, and, consequently, in some modern high-powered engine-propeller combinations, they may reach or even exceed the speed of sound.

At these extreme speeds, the air stream changes its nature and no longer behaves according to well-defined laws of fluid flow. The effectiveness of a propeller or airfoil section is contingent upon the relationship of the lift and drag of the surface. Lift is merely a pressure difference between the upper and lower surfaces of an airfoil section, and it is a widely accepted fact that pressure changes or variations are transmitted through a fluid, such as air, at the speed of sound. Consequently, when the fluid is moving at a velocity in excess of the corresponding speed of sound, these pressure variations are no longer transmitted throughout the fluid but are localized, and the effectiveness or efficiency of the propeller or airfoil decreases.

"SINCE the gas turbine experiences increased efficiency at extreme speeds, it may be possible for jet-propelled aircraft to attain flight speeds considerably in excess of the velocity of sound simply because sufficient power is available to overcome the added resistance resulting from compressibility."

Through the elimination of the propeller, therefore, the advent of the gas-turbine power plant has enabled the aircraft designer to realize the differences in speeds between the point where the propeller is effected and the point where compressibility sets in on any other part of the airplane's surface.

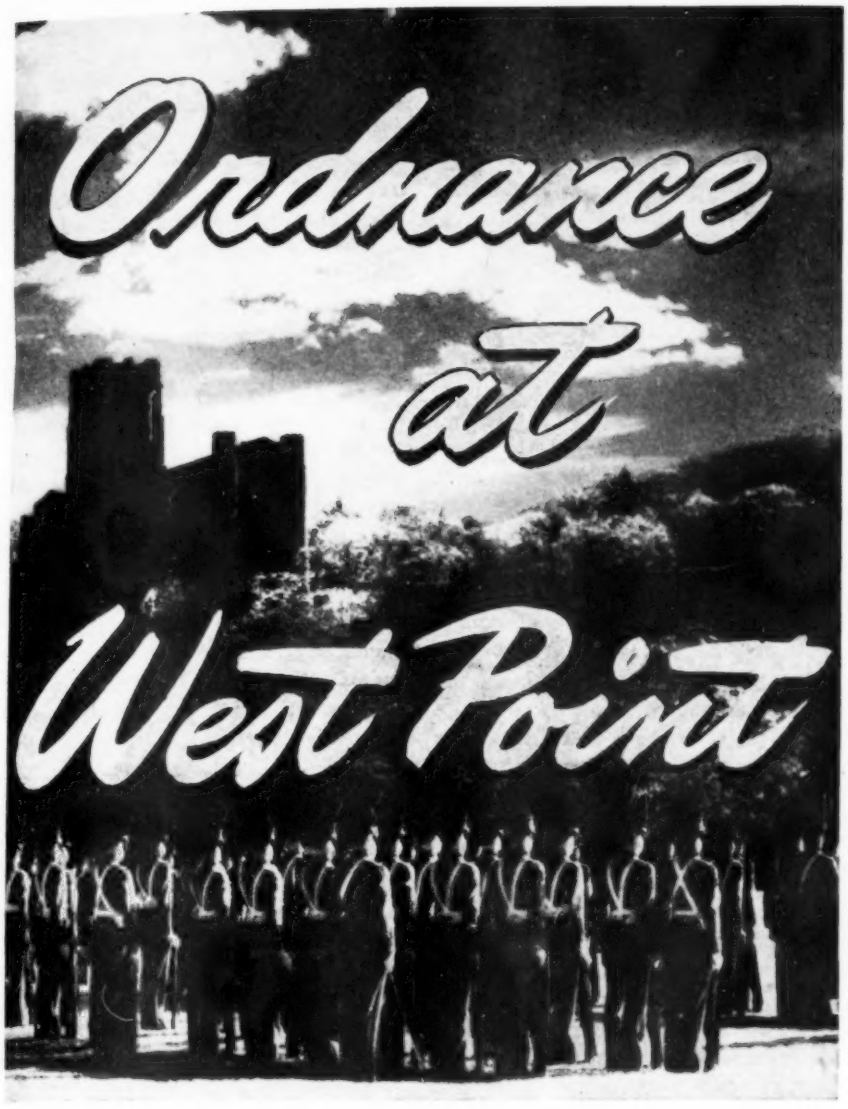
Also, since the gas turbine experiences increased efficiency at extreme speeds, it may be possible for jet-propelled aircraft to attain flight speeds considerably in excess of the velocity of sound simply because sufficient power is available to overcome the added resistance resulting from compressibility. Obviously, it can be readily appreciated to what extent jet propulsion has contributed to the solution of a problem aëronautical engineers considered inevitable, perhaps even insoluble. It has freed designers of part of their technical shackles, and it seems reasonably safe to say that the elimination of propeller problems will facilitate the exploration of supersonic speeds.

While the surface apparently has not been much more than scratched with aircraft of the jet-propulsion type, there seems to be little opposition to the contention that this kind of propulsion will bear a very strong influence in the field of future transportation. Gas-turbine-propelled aircraft at the present have a higher rate of fuel consumption than competitive power plants, and it may be that this type of power will be confined for some time to military aircraft simply for economic reasons.

However, the gas turbine offers considerable eventual promise for transportation fields. The largest field for widespread commercial use of the gas turbine for jet propulsion is undoubtedly in the heavy transportation industries, such as long-distance trucking, railroads, and steamship lines. The Diesel engine has been very satisfactorily used by all these industries, chiefly for one reason—its lower operating costs.

THE gas-turbine cycle, which is the most popular form of jet propulsion used at the present time, would be most applicable to these fields for this same reason, inasmuch as it can operate on fuels of the same quality that Diesel engines use at the present time or even on lower-quality fuels. Combined with this important factor is the additional advantage of reduced weight for the gas-turbine installation over either the Diesel or the gasoline-powered engine. Since both the gasoline and Diesel engines operate with a closed cylinder, which is essentially the cylinder and piston combination, the surrounding structure must be strong enough to accommodate peak pressures which occur intermittently during operation. In the gas turbine, since a continuous flow of combustible mixture is provided, and since the combustion itself is a continuous process, there is no necessity for a closed container of this nature and consequently no need for the heavy supporting structure. Indications are that engines of equivalent horsepower may show as high as a six to one weight disadvantage for the Diesel engine as compared with the gas turbine.

The thermal efficiency of existing gas turbines is lower than that of the conventional internal-combustion engine of either the Diesel or the gasoline type, but the reduced weight appears to offset this disadvantage, inasmuch as it allows an increase in the revenue load carried. However, jet propulsion as exemplified by the gas turbine will not have a widely applicable field in private transportation for economic reasons until such a time as the fuel consumption can be made to compete more favorably with the internal-combustion engine.



Instructing Our Future Officers in the Fundamentals of Armament

Col. Lawrence C. Leonard

"THE mission of the United States Military Academy is to produce officers of the Army having the qualities and attributes essential to their progressive and continuing development throughout their careers as officers and leaders. The mission is accomplished by education and training directed toward the inculcation and development of the requisite moral, mental, physical, and professional qualifications and attributes upon which graduates may build as commissioned officers and readily acquire the technical and professional proficiency commensurate with their duties and responsibilities."

Colonel Leonard is professor of ordnance at the U. S. Military Academy, West Point, N. Y.

Thus is outlined the official rôle of the U. S. Military Academy as approved by the War Department in 1940. Throughout its history, West Point has played a major part in producing that small group of career officers upon whose shoulders has fallen the task of training and leading our citizen armies in time of war. The Regular Army alone has not fought and won the wars into which political and economic conditions have plunged us. But the Regular Army has formed the nucleus which has carried on those professional qualifications and attributes essential to the building up of successful armies in times of crisis.

In the past, our country has not had the advantage of universal military training, yet we have waged wars successfully. In the future, conditions which have given us time to form, train, and supply huge forces quickly enough to avert disaster from aggressors may not again prevail. For the future security of our country, universal military training appears essential.

This training will not lessen, but will rather increase, the necessity for the best possible education and training of our career officers, for upon them will fall the responsibility for the success of the system. And, although the necessity for universal training is solely for the protection of the Nation and the principles for which it stands, the success of the system will depend on the inculcation and development of the requisite moral, mental, and physical, as well as the military, qualifications of the trainees. Every citizen should therefore be keenly interested in the education and training of our officers.

BEFORE discussing the place of Ordnance in the curriculum at West Point, it may be of interest to quote certain remarks made in the report of a board of consultants in 1942. This board was appointed by the superintendent of the Academy, Maj. Gen. Francis B. Wilby, to study and make recommendations regarding the wartime, 3-year curriculum which the War Department had determined to put into effect. The board was composed of: Dr. Ernest M. Hopkins, president, Dartmouth College, chairman; Dr. Karl T. Compton, president, Massachusetts Institute of Technology; Brig. Gen. Idwal H. Edwards, representing the War Department General Staff; Maj. Gen. Harold R. Bull, representing the Army Ground Forces; Brig. Gen. Clarence R. Huebner, representing the Army Service Forces; and Col. George F. Schlatter, representing the Army Air Forces.

The report of the Board stated: "After examining into the methods of instruction in the various courses offered at the Academy, the Board was greatly impressed by the thoroughness of the instruction, the alertness of the students, and the excellence in balance between the discussion allowed the student of the subject matter and the more formal aspect of recitation and instruction.

"The Board believes that the methods of instruction used both in academic and tactical subjects embody all the standard methods employed in similar

HOW to train our manhood in the ways of Ordnance—a science of deep national significance—is a problem that faces our country at this moment. That we must keep trained mentally and physically is axiomatic if we are to meet our obligations to the peace and security of our country. Here is an article on the subject of Ordnance training at the United States Military Academy at West Point. It comprises a pattern of courses that all our universities, colleges, and other institutions of learning would do well to follow.—THE EDITORS.

first-class civilian and military institutions. The Board found that modern training aids such as motion pictures, models, etc., are used to excellent advantage to enhance the instruction.

"It should be made a matter of special note that the members of the staff have been most active and alert in their contact with other educational institutions as well as with the various arms and services with reference both to teaching methods and the application of those methods to meet the basic problem presented in training of the various branches.

"The Board is definitely convinced after observation of instruction as actually carried on in the various courses that there is no justification for the popular conception that West Point instruction is rigid, stereotyped, and regimented to the mental handicap of the student. The Board concurs fully in the opinion expressed by the special committee regarding specialization in academic subjects that there should be no specialization in academic subjects solely to meet the needs of particular branches.

"The Board desires to express its appreciation to the superintendent and to all members of his staff for the many courtesies extended to members of the board and for opportunities made available for extended observation of educational facilities and methods of instruction contributing to the education and training of a West Point cadet".

WHILE education and training are interwoven into every part of the daily life of a cadet, in a broad way education is primarily the function of the academic departments and training that of the Department of Tactics. The Department of Ordnance, formerly called the Department of Ordnance and Gunnery, is an academic department. Its mission is not to prepare cadets to be Ordnance officers but to give them that fundamental knowledge of ordnance which all officers should possess regardless of the branch in which they serve.

The course given by the Department of Ordnance is supplemented by the instruction and training in the actual handling and tactical employment of weapons given by the Department of Tactics. Instruction in the fundamentals of the functioning, operation, and maintenance of automotive vehicles is conducted by the post Ordnance officer under the supervision of the commandant of cadets. This instruction is largely practical. The theoretical and more technical aspects of the subject (theory of internal-combustion engines, electricity as applied to ignition systems, etc.) are amplified in the appropriate academic departments.

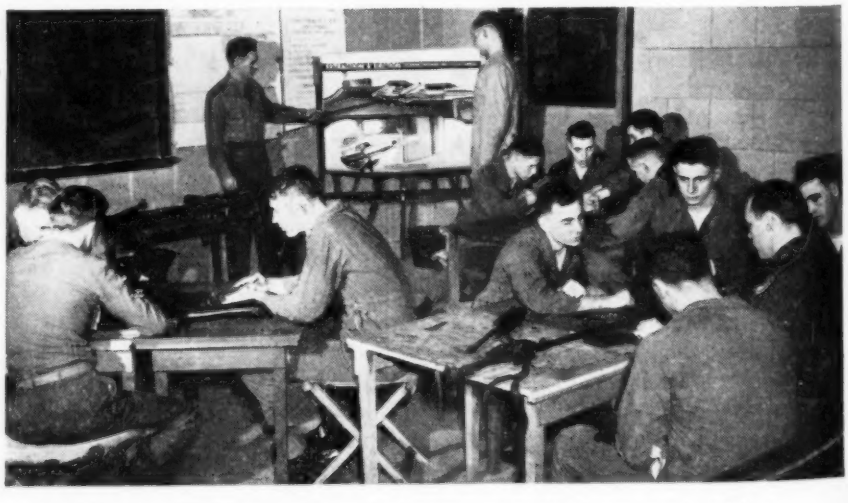
The subject of Ordnance field service is not formally covered as such. However, in the tactics of combined arms, presented by the Department of Tactics, the organization of the Ordnance Department, the types of Ordnance units and their place in the combat zone, communications zone, and zone of interior are covered and the importance of supply and maintenance emphasized. It should also be pointed out that an increasing number of instructors in the Department of Ordnance have had Ordnance service in active theaters of operation and that the cadets are eager to hear of their personal experiences and to learn their point of view.

Let us now examine the course conducted by the Department of Ordnance.

In this course, which is given during the first-class (senior) year, the cadet studies the principles involved in the design and functioning of Ordnance matériel, especially weapons and ammunition. The method of approach is to consider the requirements and then study the materials and the technical and mechanical means available for fulfilling those requirements. No attempt is made to teach all the details of particular Ordnance items, but rather every effort is made to outline the natural forces which are available or which must be overcome, the ideal solutions to the problems involved, the compromises which must be made in the practical solutions, and typical mechanisms utilized in these practical solutions.

IN studying these typical mechanisms, certain ammunition, fuzes, guns, carriages, etc., are used to illustrate the points in question. As information is received regarding new developments, this is passed on to the cadets in order that they may keep abreast of the rapid progress taking place at this time. Here again, basic principles are emphasized rather than detailed study of matériel. Extensive use of training aids is made wherever practical throughout the course. Sectionalized models, inert ammunition, wooden models, projection slides (each classroom is equipped with a projector and screen), and motion pictures are among the aids used.

The above may serve to give the reader an insight into the method of approach to the course in Ordnance. The following résumé will give a better indication of its scope and content. Before proceeding, it is desired to point out that, from an academic point of



Cadets receiving instruction on basic weapons in the Department of Tactics.

view, an excellent opportunity is provided in this course to bring out the practical application of the theories studied in other courses at the academy, especially mathematics, physics, mechanics, chemistry, and electricity. Military history also offers points of mutual interest, and the discussion of procurement and production problems ties in with the study of economics.

THE course begins with a study of explosives, their definition, classification, and the special characteristics required for military explosives. Theoretical and experimental methods for the determination of pressures, temperatures, and potential of explosives are taken up, and the characteristics, sources, and use of the principal military high and low explosives studied. The general study of explosives is followed by a study of interior ballistics, and this in turn by the general study of ammunition.

Throughout this part of the course the different requirements of the two explosive trains in a complete round of ammunition are emphasized; *i. e.*, the propellent explosive train and the bursting-charge explosive train. In interior ballistics the objective is to acquaint the student with the mode of combustion of propellants, the pressures developed, the velocity of the projectile along the bore, the effect of the density of loading, etc. This not only furnishes an understanding of the proper design of the propellent explosive train but paves the way for a later study of gun construction, breech mechanisms, and recoil. The Le Duc method is used rather than a more exact method because principles rather than exact computations are the objective.

The study of ammunition covers all the components which go to make up the various types, including bombs and rockets. Where the details of specific items are studied it is to point out typical mechanisms, assemblies, arrangements of parts, etc., so that when similar components are assembled differently to meet different requirements they can be recognized, their functions understood, and the details of the new item easily comprehended by comparison with those studied.

It is believed that if the student knows the "why" and the "how" of our basic types of matériel he can quickly acquire the specific knowledge of the types he may come in contact with later when the need arises. Without the basic knowledge he would have to start from scratch with each new item. This method also enables him to evaluate suggested or applied modifications and improvements.

Visual aids are used in the study of weapons in the Department of Ordnance.

Having studied explosives and ammunition, it is now desirable for the cadet to take up the construction of guns and carriages. The understanding of this part of the course, however, requires knowledge of the structure, properties, heat-treating, and working of metals. With the change of a few words, the following, quoted from the preface of the "Textbook of Naval Ordnance and Gunnery," U.S.N.A., 1880, applies at the U.S.M.A. today: "It is thought that no intelligent progress can be made in the subject of the manufacture of cannon, and of many of the stores used in their service, without some preliminary knowledge of the metallurgy of iron and of the means of producing the metals employed. As this subject is not taught in any other department of the Academy, it is given a place here." Laboratory work in testing materials and in heat-treating is included.

The principles of gun construction are then taken up, including centrifugal casting and cold-working. During this part of the course, production methods, manufacturing tolerances, the use of gages, jigs, and fixtures, etc., are discussed. A study of breech mechanisms and recoil mechanisms follows. Then the features of various types of artillery carriages are studied and, by means of an illustrative problem, the stresses which occur in the several members of a typical field-artillery carriage during firing are analyzed. The principles of operation of automatic weapons are also covered. During the 3-year course very little time is available for the study of exterior and bomb ballistics. However, the problems involved in the computation of ballistic data are presented and the method of solution outlined.

A VERY valuable part of the ordnance course which it has been impossible to continue during the wartime 3-year curriculum is work in the machine-tool laboratory. Here the cadets became acquainted by actual work with the basic machine tools and, while of course they did not become machinists, they did gain an appreciation of the capabilities and limitations of the machines and of the proper use of hand tools. This laboratory work will undoubtedly be resumed after the war.

Considered as a whole, the course in ordnance is intended to broaden the technical education of the cadet and give him an understanding and appreciation of the tools of his profession which will enable him to utilize them to the best advantage and imbue him with the desire to see that they are given proper care, handling, and maintenance.

Just as a driver who understands the construction and functioning of every part of his vehicle can get the most out of it without abuse, so the officer who knows ordnance, its capabilities and limitations, is better prepared to train his troops to use it to the best advantage. He will also coöperate with the personnel of the Ordnance Department who are striving to give our Army the best in equipment and in the supply and maintenance of weapons for our fighting forces.

More Firepower for the Yanks

Mounting 14 forward-firing caliber .50 machine guns as well as 2 waist guns and 2 tail guns, the version of the B-25 medium bomber shown above has terrific firepower. The M4 medium tank, below, is shown with the new 60-tube 4.5-inch rocket launcher, the "Calliope," which is rotated with the turret and elevated by the gun. It can be jettisoned from inside (Signal Corps photo).

ARMY ORDNANCE

Founded 1920

Published Bimonthly by

THE ARMY ORDNANCE ASSOCIATION

WASHINGTON, D. C.

Col. J. L. Walsh, Founder and Editor, 1920-1922
Brig. Gen. R. H. Somers, Editor, 1922-1925
Maj. Gen. R. L. Maxwell, Editor, 1925-1926
Col. C. R. Baxter, Editor, 1926-1929
Col. Leo A. Codd, Editor, 1929-1942
Brig. Gen. R. H. Somers, Editor, 1942-1944

Editor: Col. Leo A. Codd, Ord. Res.
Managing Editor: R. E. Lewis
Editorial Staff: H. P. Hill, M. L. Van Horn

ARMY ORDNANCE, the journal of the Army Ordnance Association, has no official or semiofficial governmental status. All statements expressed in the articles, editorials, and advertisements are those of the authors, editors, and advertisers and do not represent official War Department policy.

MAY-JUNE, 1945

Month by Month

The Road to Victory.—The brilliant successes of our armed forces on all battle fronts reflect the untiring leadership of their late Commander in Chief, President Franklin Delano Roosevelt, who died suddenly at Warm Springs, Ga., on April 12th when his hopes for victory over both Germany and Japan were brighter than at any time since 1941. The Nation, and particularly the armed forces whose welfare was ever close to his heart, mourns the passing of this great leader.

Yet consolation is found in the fact our new Commander in Chief, President Harry S. Truman, has pledged himself to continue Mr. Roosevelt's plans for complete victory over the Axis and for world peace, and in the fact that the military leaders Mr. Roosevelt appointed have, by their continuous victories, proved themselves superior to our enemies in every theater of operations. Never before has such military might been so well directed.

The leadership of our campaign under General Eisenhower in Europe, General MacArthur in the Philippines, and Admirals Halsey and Nimitz in the Pacific represents a type of military thinking, execution, and thoroughness for which this team is noted.

Once again leadership on the battlefield, at sea, and in the air in this war is applying the traditional tactics of surprise, terrific mobility, and overwhelming strength. We venture to say that no major campaign in the history of the world has seen the basic doctrines of the strategist and tactician applied with more telling effect.

Witness the following historic order of General Eisenhower, April 3, 1945, to every member of the AEF:

"The encirclement of the Ruhr by a wide pincer movement has cut off the whole of Army Group B and parts of Army Group H, thus forming a large pocket of enemy troops whose fate is sealed and who are ripe for annihilation. The most vital industrial area is denied to the German war potential. This magnificent feat of arms will bring the war more rapidly to a close. It will long be remembered in history as an outstanding battle—the Battle of the Ruhr."

Coequal with this leadership is the stamina, fearlessness, and self-sacrifice of the American fighting men of all arms. No greater victories have ever been won than those of the current war. In heroism, suffering, and battle casualties, the price that has been paid surpasses all previous records. The American soldier, sailor, and marine has proved himself to be a fighter of the first order, reflecting at once his own inherent manly characteristics and the excellence of his battle training. Words are not adequate to describe his achievement.

As for the superiority of our weapons, only the armchair strategist will contest their inherent worth. Armies of millions of men do not sweep across continents subduing hostile and ruthless enemies nearly every mile of the way with inferior ordnance. Not only that, but our firepower has also speed of movement enabling our fighting forces in the best American tradition to combine mobility and power. Tactical maneuver is thus restored after half a century of stalemate. And tactical maneuver has ever been the road to victory!

The Army's Technical Services.—On May 14, 1945, the Ordnance Department of the Army will be 133 years young. It is now going stronger in the performance of its vital mission than Col. Decius Wadsworth, its first Chief of Ordnance in 1812, could have dreamed. Its unbroken tradition of more than a century and a quarter is proving its value in factory and on battlefield every moment of these tragic days of the sixth major war of the Department's history.

Its mission has not changed fundamentally since the first day of its establishment. In coöperation with American industry it is par excellence the world's foremost organization for the design, production, supply, and maintenance of all the weapons with which our soldiers fight on the ground and in the air.

Along with those other outstanding technical services of the Army—the Quartermaster Corps, Corps of Engineers, Signal Corps, Medical Department, Chemical Warfare Service, and Finance Department—Ordnance and its right hand, American industry, are the salvation of our weapons' performance in the defeat of the European armies in this war and of the Japanese in the Pacific and Asia. All these time-honored agencies have contributed beyond measure in the supply functions of this hemispheric World War.

Naturally enough, they have had neither the time nor the inclination to seek acclaim for their performance. Yet these are the organizations which planned during the days of peace for total mobilization, and these are the establishments which were so capably manned and organized when emergency came in 1939 that they were ready instantly to begin their assigned tasks. Indeed, when Pearl Harbor came these old-line technical services were so far advanced in the production

of necessary supplies as well as in the design of needed equipment that the herculean job of arming our allies and its smooth performance were assured.

The future of our Army demands a strengthening of these services both in personnel and in organization. There is a marked tendency to underestimate their importance, to reduce them to impotence, and to give scant praise to the marvelous work they have done. After the war is won, these old-line technical services must be upheld and strengthened.

So, too, with the fighting organizations whose histories make us great. Unfortunately, the Infantry, Cavalry, Coast Artillery, and Field Artillery have lost much of their former status in the present setup. They too must be returned to their accustomed places of traditional and effective importance. It has taken the Burma jungle, the pillboxes of the Ardennes, and the conquest of the Rhine—plus the pleas of a Stilwell—to bring the Infantry back to her accredited throne as the Queen of Battle.

This war is being won not by the superorganizations which have emerged within the Army but by the infantrymen, the artillerymen, and the experts of the technical services of which the Industry-Ordnance team is a worthy part. All these are the elements that make our Army great.

Tank Performance.—General Patton's own brand of lightning war has carried the famed American Third Army into the very heart of Germany. But apparently some critics still doubt the superiority of our American light and medium tanks! If the map itself is not sufficiently convincing by this time, then the following additional testimony from the great Patton should settle the matter. It is a letter addressed to Gen. Thomas T. Handy, Deputy Chief of Staff.

The text of General Patton's letter, written from Third Army headquarters under date of March 19th and referring to the presence of the army at Mainz, Germany, follows:

"My dear General Handy: It has come to my knowledge that certain misguided or perhaps deliberately mendacious individuals, returning from the theater of war, have criticized the equipment of the American soldier. I have been in command of fighting units since the 7th of November, 1942, and may therefore claim some knowledge of the various types of equipment.

"With reference to the tank, either Mark V (light) or Mark IV (medium), it has been stated at home that these tanks are not comparable with the German Mark VI, the so-called Panther and Tiger type tanks. This statement is wholly incorrect for several reasons. (Ed. Note.—The Mark IV is generally known in this country as the General Sherman and the Mark V as General Stuart.)

"Since August 1, 1944, when the Third Army became operational, our total tank casualties have amounted to 1,136 tanks. During the same period, we have accounted for 2,287 German tanks, of which 808 were of the Tiger or Panther variety; 851 on our side were Mark IV.

"These figures of themselves refute any inferiority of our tanks, but let me add that the Third Army has always attacked and therefore better than seventy per cent of our tank casualties have occurred from dug-in antitank guns and not enemy tanks, whereas a majority of the enemy tanks put out have been put out by our tanks.

"It is patent that if a Tiger tank with an enormous thickness of armor were put at one end of a village street and engaged in a fire fight with a Mark IV tank at the other end, the Mark IV tank would not last. However, the great mobility of the Mark IV tank usually enables it to circumvent the slow and unwieldy Tigers and not to engage in a slugging match but to attack them from the rear.

"With the advent of the heavy, cumbersome Tiger tank, the German, in my opinion, lost much of his ability in armored combat. These tanks are so heavy and their road life is so short that the German uses them as guns and not as tanks; that is, he uses them on the defense against our armor, whereas we invariably try and generally succeed in using our armor on the offense against his infantry, which is the proper use of armor.

"Had the armored divisions which accompanied the Third Army across France been equipped with Tiger tanks, the road losses would have been one hundred per cent by the time we reached the Moselle River. As it was, the road losses on our long-lived tanks were negligible.

"In the current operation, had the 4th Armored Division been equipped with Tiger and Panther tanks and been required to make the move from Saarguemines to Arlon, then through to Bastogne, from Bastogne to the Rhine, and now to Mainz—it would have been necessary to rearmor it twice, and furthermore, it would have had serious if not insurmountable difficulty in crossing rivers.

"Finally, we must remember that all our tanks have to be transported on steamers, and the difference between forty tons and seventy tons is very marked. A 70-ton tank could never have been brought ashore in landing boats as many of our medium tanks were. Nor could they have marched from the Cotentin Peninsula to the Rhine as practically all our tanks have been required to do.

"In mechanical endurance and ease of maintenance, our tanks are infinitely superior to any tank in the theater of war. The outstanding advantage which our tanks possess over the German tank is the mechanical traverse and stabilizer, through the use of which we get most of our kills."

More About Tanks.—In the light of General Patton's letter, above, it is pathetic to note the misunderstanding of our tank situation by some analysts and commentators. Frequently our Sherman tank is compared with the German Royal Tiger and the Russian Stalin. In the press we are shown comparative diagrams vividly portraying—to the obvious disadvantage of the Sherman—the principal military characteristics of the three.

Naturally the question arises, why does the American Army not have a heavy tank? The answer is that our military high command had not seen fit to approve one. The Industry-Ordnance team designed and built heavy tanks, sixty tons, heavily armed and armored, more than three years ago.

The traditional concept of mechanized warfare has always been that there should be three types of tanks: light, medium, and heavy. It is so with naval warfare (destroyer, cruiser, battleship). It is so with air warfare (fighter, medium bomber, heavy bomber). But the triumphant march of General Eisenhower's forces into the very heart of Germany ought to be proof that our fighters know where they are going, and how!

Our Arms Must Also Win the Peace

An Editorial

WHEN this issue of ARMY ORDNANCE appears, the United Nations Security Conference will have convened at San Francisco. Its purpose will be to adopt measures to guarantee the peace of the world. All right-thinking people hope and pray that the conference will be a success in every particular. We of the United States are fully conscious of the stark tragedy of war and of the necessity for the peaceful settlement of international differences. We have sacrificed our manhood and our substance in fabulous degree to defeat our enemies, and we are determined to exert our unswerving influence in upholding the decisions to be reached at San Francisco. Peace is a great blessing. It demands the unselfish coöperation of us all, nationally and internationally.

¶ But let us not make the mistake this time we have made consistently in the past. After all our wars we have forgotten the realities and put our faith in words alone. This time let us coöperate to the fullest extent in all peaceful measures, but at the same time let us keep our military and naval armament strength commensurate with our vast responsibilities. If, after this war is won, we allow our guns to rust, our Navy to disintegrate, our Air Forces to become weak, and our Army to be a shadow of its necessary strength in men and matériel, then the decisions at San Francisco will be merely a display of diplomatic skulduggery. Especially will this be true if we dissipate our Industry-Ordnance strength and destroy the capacity—material and mental—to produce weapons of superior quality in adequate quantity for our armed forces.

¶ Once before, indeed as recently as 1921, the American people, flushed with the pride of victory and determined that war would never come again, entered the Washington Conference and emerged from it with our Navy completely scuttled. In our desire to coöperate for peace we deliberately destroyed a greater tonnage of combat vessels, built and building, than had ever before been sunk in any naval battle in history. We must not repeat at San Francisco what we did at Washington. On the contrary, while making every possible concession to guarantee the peace we must also maintain our armament strength and prove to the world that we not only want peace but, with the help of Almighty God, we intend to have it.

Association Affairs

ANNUAL DIRECTORS' MEETING

The annual meeting of the board of directors of the Army Ordnance Association was held at the University Club, New York City, February 14, 1945. The following officers and directors were present:

President: Benedict Crowell; vice-president: Frederick H. Payne; treasurer: Chas. Elliot Warren; counsel: John Ross Delafield; assistant treasurer: Henry P. Erwin; secretary: L. A. Codd; directors: Samuel McRoberts, Robert P. Lamont, James L. Walsh, Thomas A. Morgan, William C. Dickerman, George W. Elliott, Harvey C. Knowles, K. T. Keller, Arthur W. Herrington, and Allen Rushton. By invitation of the president, R. E. Gillmor, president of the New York Post, also was present.

The first order of business was the discussion and adoption of a resolution presented by Colonel Walsh in praise of the combined operations of the Ordnance organizations of the Army and Navy and American industry for victory. The resolution is published in full on page 432.

The annual report of the treasurer, General Warren, disclosed that the fiscal year, ending December 31, 1944, was the period of greatest financial activity of the Association in so far as current operations are concerned. While the year 1943 witnessed the completion of the Ordnance Endowment Fund, and therefore included larger cash totals, still the year 1944, from a current operations standpoint, represented an increase in normal receipts of $121,593.99—from $214,617.24 in 1943 to $336,211.23 in 1944. During the same period, operating expenditures increased $109,102.95—from $120,178.43 in 1943 to $229,281.38 in 1944 including $26,660 which, by action of the executive committee, was distributed to local Posts in addition to their normal refunds.

Source	*1944*
Renewal membership dues:	
Individual	$ 38,764.49
Group	40,730.00
New membership dues:	
Individual	104,182.86
Group	21,348.00
Life membership dues	23,371.00
Magazine subscriptions:	
Renewal	5,271.52
New	3,780.13
Advertising	86,188.51
Annual Meeting	8,590.00
Interest	3,024.92
Miscellaneous	959.80
Total operating income	$336,211.23
Alden Prize Essay Fund	5,000.00
Sale of securities	1,757.54
Total	$342,968.77

Army Ordnance Association Receipts, 1944

Financial statements showing the Association's receipts and expenditures for the year 1944, accompanied the report and are published herewith. The annual audit conducted by Ernst & Ernst, as of the end of the year, has not been completed. The figures given in the report are subject to modifications by the auditors.

The secretary's report disclosed that the membership increased during the year by 77 per cent, to 30,898. Four new local Posts were established during the year. FIREPOWER, a new bimonthly magazine, stressing the military phase of ordnance operations, was inaugurated.

A board of members, under the chairmanship of Col. William W. Coleman, vice-president of the Association, presented a report on postwar preparedness, being a proposed military-industrial program for the national defense. This report was published in the July-August 1944 issue of ARMY ORDNANCE and is an excellent outline of the Association's principles and policies.

Ordnance production for victory was the keynote of all activities of the Association throughout the year. It was stressed at the twenty-fifth annual meeting held at the Waldorf-Astoria, New York City, January 19, 1944. The meeting was attended by more than 1,500 members and guests and included sessions on ordnance production, engineering, field service, and training. Twenty-four distinguished leaders in military and industrial life participated in the discussions. A feature of the meeting was a display of ordnance equipment from the Aberdeen Proving Ground.

Local Posts of the Association were exceptionally active during the year. In many cases meetings of national import were held, membership drives were conducted, and visits to plants and military establishments were made.

In conformity with a resolution of the executive committee, steps have been taken to form industry divisions within the Association. Each member will be enrolled as a member of the industry division of his choice, in addition to membership in the local Post in whose area he resides. Twelve such divisions will be organized.

During the year the three regular publications were continued with constantly increasing circulation. ARMY ORDNANCE averaged 193 pages an issue. Army Ordnance Reports were issued three times during the year and were devoted to the following special subjects:

"Operation of Special Ordnance Plants," by Lieut. Col. Henry T. Bodman; "Steel Cartridge Cases," by Lieut. Col. Harold R. Turner; and "Ordnance Ammunition Production," by Hon. Albert J. Engel.

Army Ordnance Bulletin, the monthly newsletter from Washington, published on the fifteenth of each month, continued to be most popular. FIREPOWER was begun as a bimonthly publication on June 1, 1944. It has a considerable following, especially overseas. Copies are distributed gratis to all Ordnance organizations abroad and to all enlisted men and noncommissioned officers of the services who request it.

The president announced the appointments to standing committees for the year as follows: **Membership:** Edward T. Gushée, Detroit, Mich. (chairman); S. C. Hope, Springfield, Mass.; Lieut. Col. William M. Reno, Denver, Colo.; Louis Polk, Dayton, Ohio; and Col. D. J. Martin, Washington, D. C. **Endowment:** T. M. Girdler, Cleveland, Ohio (chairman); Capt. James D. Mooney, U.S.N., Washington, D. C.; H. B. Harvey, Chicago, Ill.; Charles W. Dupuis, Cincinnati, Ohio; and Lieut. Col. D. K. Bullens, Pottstown, Pa. **Meetings and Programs:** R. C. Force, San Francisco, Calif. (chairman); W. E. Crocombe, Chicago, Ill.; Dr. C. G. Storm, West Hanover, Mass.; Walter N. Howley, Gadsden, Ala.; and Dewey D. Day, Dallas, Tex. **Studies, Reports, and Seminars:** E. F. Johnson, Detroit, Mich. (chair-

man); Maj. Roy D. Hickman, Birmingham, Ala.; W. R. England, Houston, Tex.; Col. S. B. Ritchie, Washington, D. C.; and Dr. E. R. Weidlein, Pittsburgh, Pa. **Research:** Maj. Gen. G. M. Barnes, Washington, D. C. (chairman); Frank B. Bell, Pittsburgh, Pa.; Brig. Gen. Wm. I. Westervelt, New York, N. Y.; Dr. Henry B. Allen, Philadelphia, Pa.; and H. P. Richardson, Boston, Mass. **Library:** Brig. Gen. R. H. Somers, Hanover, N. H. (chairman); Karl Vogel, Omaha, Nebr.; H. B. Deal, St. Louis, Mo.; Frank R. Bacon, Milwaukee, Wis.; and Col. Henry P. Erwin, Washington, D. C. **Military Education:** Brig. Gen. H. R. Kutz, Washington, D. C. (chairman); Brig. Gen. Earl McFarland, Staunton, Va.; John E. Johnson, Detroit, Mich.; Col. L. C. Leonard, West Point, N. Y.; and Col. W. R. Slaughter, Aberdeen, Md. **Coöperation with Other Organizations:** H. M. Tillinghast, New York, N. Y. (chairman); B. E. Hutchinson, Detroit, Mich.; Watt Fallis, Seattle, Wash.; B. T. McNeil, Houston, Tex.; and Robert F. Black, Cleveland, Ohio.

On the suggestion of the president, the following resolution was presented by Mr. Dickerman, seconded by General McRoberts, and duly adopted:

"Resolved that there be appointed a Special Committee on Aims and Organization under the chairmanship of Col. H. A. Gidney, president of the Pittsburgh Post, with Col. James L. Walsh as vice-chairman, the committee members to consist of Mr. Keller and the presidents of each of the twenty-four active local Posts of the Association. The committee will be requested, after due study and deliberation, to report to the board of directors any proposed revision of the aims and organization of the Association and of the constitution and by-laws to conform therewith."

Purpose	*1944*
Salaries	$ 31,988.17
Office expense	10,645.36
Contributions to local Posts	43,701.29
Postage	3,961.64
Rent	3,941.50
Membership extension	8,465.83
Contingencies (travel, etc.)	2,920.72
Annuities, insurance, and bonding	1,409.14
Office equipment	9,231.36
Endowment Committee	720.31
Publications	99,096.99
Annual meeting	13,199.07
Total expenditures	$229,281.38
Purchase of securities	50,000.00
Total	$279,281.38

Army Ordnance Association Expenditures, 1944

ST. LOUIS POST

A most remarkable record has been established among Army Ordnance Association members in the St. Louis Ordnance District. Since Pearl Harbor four of the eight new Posts have been installed in that area. Another, to be known as the Mid-Western Post, with headquarters at Kansas City, Mo., is in process of formation. With membership already signed up for the newest addition, the St. Louis Ordnance District has sixty per cent of all the life members of the Association and one-sixth of the total national membership, although the industrial population of that area is much smaller proportionately. In tribute to the remarkable work done in these fields, Brig. Gen. Benedict Crowell, president of the Association, has awarded the Army Ordnance Gold Emblem to Col. Clyde H. Morgan, chief of the District, and Col. Richard W. Coward, assistant chief. The emblems were presented by Maj. Gen. L. H. Campbell, Jr., Chief of Ordnance, at a meeting of the St. Louis Post at Jefferson Barracks, Mo., April 6th. A complete account of this historic meeting will be published in the next issue.

NORTHWEST POST

The twenty-seventh local chapter of the Army Ordnance Association came into being at the inaugural meeting of the Northwest Post on March 15, 1945, at Minneapolis, Minn. Brig. Gen. James Kirk, well-known small-arms authority of the Ordnance Department, was the principal speaker. Maj. Roland F. Wilson, Ordnance Reserve, who began the organization of the Post several months ago, presided. More than 300 members and guests were present at the meeting. General Kirk paid high compliment to Ordnance production by industries within the area of the new Post.

"What is now your part in this great undertaking? At the close of 1944," he said, "the face value of outstanding Ordnance contracts in Minnesota, North and South Dakota, totaled approximately $225,000,000. If we included prime Government contracts for all supply items, the total was $750,000,000. These are prime contracts alone and do not reflect the very substantial subcontracting activities of the area."

Following the presentation of the charter to the new Post by Col. L. A. Codd, executive vice-president of the Association, there was a short business meeting at which the constitution and by-laws of the new chapter were adopted and officers elected. The constitution was presented by Frank B. Winston who also announced the selections of the nominating committee.

The following officers and directors were unanimously elected: *President:* Luther S. Oakes, president, Winston Brothers Company, Minneapolis, Minn. *Vice-presidents:* Walter G. Seeger, president, Seeger Refrigerator Company, St. Paul, Minn.; Harry A. Bullis, president, General Mills, Inc., Minneapolis, Minn. *Secretary-treasurer:* Roland F. Wilson, major, Ordnance Reserve, Minneapolis, Minn. *Directors:* The officers and C. E. Buckbee, Richard P. Carlton, Alex D. Chisholm, Charles L. Horn, W. F. Kasper, W. C. MacFarlane, Lieut. Col. A. V. Stallard, Harold W. Sweatt, Alfred M. Wilson, Mr. Winston, and Brison Wood. *Executive Committee:* The officers of the Northwest Post and Messrs. Horn, Winston, and MacFarlane.

The new Northwest Post includes all members resident in Minnesota, North Dakota, and South Dakota. There are approximately 777 members within the area.

Major Wilson, Post secretary, is entitled to a deep measure of thanks for his untiring efforts in organizing the Post. Long an advocate of a local chapter in this area, he called an organizational meeting on October 18, 1944, when a small group of businessmen and Army officers gathered informally at the Minneapolis Athletic Club to consider the advisability of such a group.

QUAD-CITIES POST

Col. C. A. Waldmann, commanding officer, Rock Island Ordnance Center, Rock Island, Ill., presided at an informal meeting of members of the Army Ordnance Association resident in the Davenport-Rock Island-Moline-Bettendorf area to consider the advisability of establishing a local Post of the Association there. The meeting was held in the Empire Room of the Blackhawk Hotel, Davenport, Iowa, on the evening of March 6th. Participating in the discussions were Lieut. Col. F. W. Renwick, Jr., secretary of the Chicago Post; Lieut. Col. J. W. Karraker of the Chicago Ordnance District, and Col. L. A. Codd, executive vice-president of the Association.

At the conclusion of the meeting, the following members of the Committee on Charter and Organization were appointed: Col. Charles D. Wiman, Deere & Company, Moline, Ill., chairman; H. W. Getz, Williams-White Company, Moline, Ill.; A. E. Hageboeck, Frank Foundries, Moline, Ill.; H. J. Kicherer, International Harvester Company's Farmall Works, Rock Island, Ill.; Henry S. Lord, French & Hecht, Davenport, Iowa; T. E. Stahl, J. I. Case Company, Rock Island, Ill.; and William B. Walker, Rock Island Arsenal. The committee is now at work on the organization of the new Post. It will be the twenty-eighth local chapter of the society.

ABERDEEN POST

Congressman James W. Wadsworth, Jr., was the principal speaker at the first meeting of the Aberdeen Proving Ground Post, February 24, 1945. His address is published on page 386 of this issue. It is a stirring plea for universal military training.

Col. Willis R. Slaughter, president of the Post, presided at the meeting. Maj. Gen. C. T. Harris, Jr., commanding general, Aberdeen Proving Ground, welcomed the more than 1,200 members and guests. Maj. Gen. Thomas J. Hayes, chief, Industrial Service, Ordnance Department, also addressed the meeting and spoke in high praise of Congressman Wadsworth's service to the Nation and particularly to the Ordnance Department.

"Our entire military structure is today based upon the National Defense Act of 1920," said General Hayes, "and Representative Wadsworth is the father of that act. Whatever comes out of our experience in this war, those of us who know the problems of Ordnance are convinced that what the act specifies for industrial preparedness will be as important in the days to come as it was in the years preceding this war."

At its second meeting the Post had an equally distinguished guest in the person of K. T. Keller, president of Chrysler Corporation, father of the Detroit Tank Arsenal, and a director of the Association. Mr. Keller's address is also published in full in this issue on page 418. A leader of American industry and a genius of automotive production, Mr. Keller through his vast organization has contributed to ordnance progress in this war in untold measure. Mr. Keller is a member of the Association's Committee on Aims and Organization and is also a director of the Michigan Post.

In the absence of Colonel Slaughter, Col. George G. Eddy, acting president, presided. The welcoming address was again given by General Harris, and the closing remarks were made by Brig. Gen. H. R. Kutz, chief of the Training Service, Ordnance Department. General Kutz bespoke the appreciation of the entire Ordnance Department for Mr. Keller's outstanding service, especially in the fields of automotive, artillery, small-arms, and ammunition production.

Both meetings were preceded by luncheon for the honor guests at the Officers' Club. Music was by the 324th Army Service Forces Band. The following officers of the Post were in charge of the arrangements: Brig. Gen. H. J. Lawes, Col. H. G. Stanton, Col. Charles K. Allen, Col. O. G. Kreiser, Lieut. Col. W. C. Farmer, Lieut. Col. O. R. Schurig, Lieut. Col. E. S. Palmer, Maj. J. A. Westbrook, Maj. C. J. Koenig, Maj. K. J. Hackett, and Mr. Robert Kent.

Resolution in praise of Army-Navy-Industry Coöperation

"Resolved **that the officers and directors of the Army Ordnance Association assembled at New York City this fourteenth day of February, 1945, for their annual meeting, express on behalf of the nearly 40,000 members of the Association their profound appreciation, congratulations, and thanks to all components of the Industry-Ordnance team for their historic contribution to victory in the present war.**

"Under the guidance of Maj. Gen. L. H. Campbell, Jr., Chief of Ordnance of the Army, in close cooperation with Adm. George F. Hussey, Jr., Chief of the Bureau of Ordnance of the Navy, members of the Industry-Ordnance team have designed, developed, produced, and are constantly improving superior armament in quantities unheard of in the history of the world.

"Included in these felicitations are all service personnel—officers and enlisted men; all members of American industry—labor, management, men and women—especially all military and naval personnel who at great personal hardship and inconvenience are serving overseas with Ordnance units ashore, afloat, and aloft. To them we join with a grateful Nation in expressing appreciation in the rôle of armorer. They have sustained an ancient tradition and have brought to our civilization in the twentieth century a type of public service for which all their fellow citizens are profoundly grateful and of which they will always be proud."

PHILADELPHIA POST

With "production for total victory" as their theme, more than a thousand representatives of war industry in the 7-state area of the Philadelphia Ordnance District met to hear Maj. Gen. Levin H. Campbell, Jr., Chief of Ordnance, speak and to honor him with the first annual presentation of the John C. Jones Medal. The representatives met at a dinner-conference sponsored by the Philadelphia Post of the Army Ordnance Association on February 5th at the Bellevue-Stratford Hotel in Philadelphia.

General Campbell paid tribute to C. Jared Ingersoll, chief of the Philadelphia Ordnance District who acted as the meeting's chairman, as he accepted the Jones Medal for "distinguished service to Ordnance" in 1944. In accepting the medal, General Campbell said that he could "only do so, I am sure, not on behalf of myself but on behalf of every member of our great Industry-Ordnance team. I accept it in very great humility—knowing my complete unworthiness for such an honor. The part I play in this great effort is indeed very small."

General Campbell told of the answers that he had received from some of America's leading generals in the European and Mediterranean theaters during his recent tour of the battle fronts to learn how American industry could best be geared to the fighting ahead. Those to whom he talked included Generals Eisenhower, Simpson, Hodges, Patton, Bradley, Patch, Devers, Clark, and Truscott, and Field Marshal Alexander of the British Army.

In his talk with General Eisenhower, General Campbell said that they discussed "very, very thoroughly, Ordnance and Ordnance equipment, Ordnance service, Ordnance supply, and Ordnance maintenance. I went there," he said, "for the purpose of inquiring what else industry and what else the Ordnance soldier could do for General Eisenhower and his troops." The general, he said, was thoroughly complimentary of the quality of ordnance.

In his talks with the other generals, General Campbell said that their answers were almost unanimous. They wanted more ammunition, more trucks, more tires, more tubes, and more of the critically short items. He told of General Patton's desire for more tanks with the 75-mm. gun and General Simpson's wanting more tanks with the 90-mm. gun.

The John C. Jones Medal awarded to General Campbell is a newly established annual presentation in honor of the first chief of the Philadelphia Ordnance District. It is given to the "individual who is deemed to have made the most distinguished contribution in the design or production of ordnance matériel during the preceding year."

Members of the Post who served on the committee planning the dinner included Maj. Ernest J. Langham, chairman; Henry P. Patchett, vice-chairman; Maj. A. B. Allison, Guy C. Beishline, Edward G. Budd, Jr., Col. D. K. Bullens, Joseph A. Cunningham, Andrew N. Farnese, J. J. Fitzpatrick, J. A. Foley, Caleb Fox, III, C. H. Godschall, Russell Hall, H. S. Lewis, C. E. McManus, Jr., C. J. Moran, Thomas S. Quinn, Marshall E. Reid, William S. Shipley, Capt. Charles W. Sorber, Thomas Starke, George B. Troxell, Capt. Eugene H. Uhler, Wilbert Wear, and Capt. Bernard M. Zimmerman.—LIEUT. ALBERT T. COLLINS.

CINCINNATI POST

On the evening of February 21, 1945, over 800 members attended the annual meeting of the Cincinnati Post, Army Ordnance Association, in the Hall of Mirrors, Netherland Plaza Hotel, Cincinnati, Ohio. Greater interest was shown in this meeting than in any other previous one in this area. Several hundred requests for reservations had to be turned down.

At this meeting Maj. Gen. Levin H. Campbell, Jr., Chief of Ordnance, who had been invited as principal speaker, was surprised by being awarded the first annual award of the Cincinnati

Post, Army Ordnance Association, presented by the C. L. Harrison family, for outstanding service to Army Ordnance. C. L. Harrison was the first president of the Army Ordnance Association of Cincinnati and chief of the Cincinnati Ordnance District from 1918 to 1936.

General Campbell, addressing the group, called for greater production of military supplies and requested every individual, whether high-placed executive or common laborer, to perform his war job loyally rather than seek a secure peacetime job.

"It was a great experience for me," he said, "to talk to the generals who command our fighting forces in the European theater of operations. You can perhaps share to some extent the pride I felt when General Eisenhower told me he is satisfied with materials and equipment that Ordnance is sending to the allies. When General Patton told me that he considers American tanks without equal among armies of the world, I could not help but be gratified. He told us what he wanted and we made it for him. He is fighting with it now, and he is satisfied."

Among the distinguished guests present were: Maj. Gen. T. J. Hayes, Brig. Gen. R. E. Hardy, Col. M. C. Burnside, Col. A. A. Busch, Col. T. C. Gerber, Col. T. M. Jervey, Col. F. A. McMahon, Lieut. Col. F. A. Muhlenberg, Lieut. Col. P. J. Pickens, Capt. G. H. Bowman, and Messrs. Scott Alter, J. M. Baker, H. C. Blackwell, R. G. Calton, J. M. Daly, J. B. Doan, W. H. Dress, C. W. Dupuis, Roger Ferger, F. V. Geier, Elmer Henlein, O. S. Hunt, Harvey Knowles, E. A. Muller, A. H. Pugh, August Tuechter, and Calvin Verity. General Hayes is chief, Industrial Service, Office of the Chief of Ordnance; General Hardy is chief, Ammunition Division, Office of the Chief of Ordnance; and Colonel McMahon is special assistant to the chief of the Field Service Division, Office of the Chief of Ordnance.

Entertainment during the dinner was provided by the Cincinnati Ordnance District Employees' Club mixed chorus of fifty voices. High-lighting this program was the group's own arrangement of the Army Ordnance Cannon March.

During meetings held prior to the dinner, Col. J. C. Shouvlin, chief, Cincinnati Ordnance District, and Louis Polk, president of the Sheffield Corporation, Dayton, Ohio, manufacturers of precision gages, were awarded the Army Ordnance Association Gold Membership Emblem.—MAJ. J. C. CONNIFF, *Ord. Dept.*

CLEVELAND POST

The Cleveland Post continues one of the most aggressive membership campaigns in the history of the Association. Under the untiring direction of Clifford F. Hood, president of the Post, and his capable assistant, William I. Ong, meetings have been held in the principal industrial areas of the Cleveland Post territory. Col. E. A. Lynn, chief of the Cleveland Ordnance District, is one of the most active exponents of the Post's activities. In the last issue of ARMY ORDNANCE, reports were published of meetings held in various sections of the State of Ohio during the early part of the year. More recently meetings have been held at Cleveland, Canton, Columbus, Mansfield, and Youngstown.

At Cleveland on March 2, 1945, a meeting was held which was unique in the annals of the Army Ordnance Association. Its chairman was Albert J. Weatherhead, Jr., president of the Weatherhead Company and a director of the Cleveland Post. Gen. Joseph W. Stilwell, Commanding General of the Army Ground Forces, was the principal speaker. His address is published in full as the leading article in this issue.

Preceding General Stilwell's address, a brief talk on jet-propulsion aircraft was given by Maj. Gen. K. B. Wolfe, commanding officer, Wright Field, Dayton, Ohio. Tom M. Girdler, chairman of the board of the Republic Steel Corporation, and a director of the Cleveland Post, was presented the John H. Rice Gold Medal. The presentation was made by Brig. Gen. Benedict Crowell, president of the Association. Mr. Hood also spoke briefly on the purposes of the organization and praised the committee for its efforts in adding 1,792 new names to the Post's membership roster from the Cleveland area.

Each guest at the dinner, attended by more than 600, was presented a novel program. It was a souvenir dinner plate carrying a map of the "Stilwell Road" in Burma, a likeness of the General, and the program. The committee in charge, in addition to Mr. Weatherhead and Mr. Girdler, included R. J. Wysor, Ben F. Hopkins, James F. Lincoln, F. H. Chapin, John C. McHannan, A. C. Ernst, Joseph Eaton, and George Codrington.

To Mr. Weatherhead and his capable assistants, Gene Robers and Miss P. M. Gaffney, goes a full measure of thanks for a meeting unique in the annals of the Army Ordnance Association. With his customary enthusiasm, Mr. Weatherhead is conducting the Cleveland membership activities and is meeting with well-merited success.

At Canton, March 8, 1945, W. Robert Timken, regional representative of the Army Ordnance Association and vice-president of Timken Roller Bearing Company, tendered a dinner in honor of the chief executives of industries of the Ohio counties of Stark, Wayne, and Tuscarawas interested in developing and maintaining adequate defense during peace. The principal speaker was Brig. Gen. E. E. MacMorland, chief, Stock Control Division, Ordnance Field Service. He was introduced by Colonel Lynn.

General MacMorland said in part:

"Ordnance units helped smash Marshal von Rundstedt's Ardennes offensive last December by evacuating almost all the gasoline, ammunition, vehicles, and other supplies from supply depots in the bulge. Ordnance losses from all causes since D-day amount to about $500,000,000 and include 166,000 rifles, 23,000 machine guns and mortars, and 34,000 general vehicles.

"One Ordnance unit alone removed 10,000 tons of supplies and 1,500 vehicles from the path of Von Rundstedt's advancing divisions, whose objective was the great supply depot at Liege."

The meeting was held at the Hotel Onesto. In addition to Mr. Timken, General MacMorland, and Colonel Lynn, the following guests were sitting at the speakers' table: T. K. Harris, president, T. K. Harris Company; Maj. R. W. James, chief, Tank and Automotive Branch, Cleveland Ordnance District; G. A. Wilt, treasurer, Massillon Steel Casting Company; H. A. Fennerty, president, Alliance Machine Company; Russell Horn, divisional superintendent, Republic Steel Company; C. F. Klein, mayor of Canton; Comdr. A. N. Connett, U.S.N., commanding officer, U. S. Naval Ordnance Plant; F. G. Hoover, vice-president, Hoover Sweeper Company; Col. L. A. Codd, executive vice-president, Army Ordnance Association; Charles Balough, president, Hercules Motors Corporation; J. D. Raridan, editor, the *Canton Repository;* Maj. C. G. Wood, Cleveland Ordnance District; and Lieut. Col. W. C. Sanders, general manager, Railway Division, Timken Roller Bearing Company. In addition, 125 leaders of industry in the area were present.

To Mr. Timken and Colonel Sanders, the Army Ordnance Association is greatly indebted. This meeting developed a degree of interest and support for industrial preparedness in one of the most important business areas of the country and will have a lasting effect on industrial-mobilization planning in time of peace.

At Youngstown, March 14, 1945, Henry A. Roemer, chairman and president, Sharon Steel Corporation, Sharon, Pa., was chairman at an important meeting in honor of Colonel Lynn. It was held at the Youngstown Country Club. The speakers included the honor guest, Mr. Hood; Mr. McHannan; George E. Whitlock, president, Mullins Manufacturing Corporation; Capt. Paul Brown and Maj. C. W. Steadman of the Cleveland Ordnance District. More than one hundred industrial leaders of the area were in attendance. Mr. Roemer, genial, capable, and loyal supporter of the Ordnance cause has done many fine things for the Army Ordnance Association in recent years. This meeting will have a far-reaching effect on the work of the society for adequate industrial preparedness.

At Columbus, March 22, 1945, Clyde W. Williams, director, Battelle Memorial Institute, presided at a luncheon tendered to the leading citizens of that area. The principal speaker was Col.

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L. A. Codd, executive vice-president of the Association. Mr. Williams invited more than fifty leaders in the fields of the ministry, education, the professions, and business to consider the program of the Association for industrial preparedness. There was a general agreement on the need for a program to acquaint the citizens of our country with the importance of armament preparedness. Subsequently, a larger meeting will be held at which Ordnance research and engineering will be given special emphasis. Mr. Williams was assisted by J. S. Crout of the Battelle Memorial Institute staff.

MEMBERSHIP EMBLEMS AWARDED

Brig. Gen. Benedict Crowell, president of the Association, has conferred the Association's Gold Membership Emblem upon the following members, in special appreciation of their efforts and help toward increasing the membership:

Col. Clyde H. Morgan, chief of the St. Louis Ordnance District, for his energetic coöperation in the establishment of new local Posts throughout the St. Louis Ordnance District. During his tenure, the total membership within the district has increased more than sixty per cent, and the number of new Posts has risen from two to six. The presentation of the award was made by the executive secretary of the Association at the annual meeting of the St. Louis Post, held at Jefferson Barracks, Mo., April 6, 1945.

Col. Richard W. Coward, assistant chief of the St. Louis Ordnance District, whose energy, loyalty, and executive ability have rallied countless new members to the Association throughout the district. His wide acquaintance among industrial and military personnel have resulted in the largest increase in life membership in the history of the Association. Seventy per cent of the life members are resident in the St. Louis Ordnance District's territory. In addition, Colonel Coward has assisted immeasurably in the establishment of new local Posts.

Maj. Roland F. Wilson for his masterful organization of the new Northwest Post (see page 431). An active Reserve officer, Major Wilson for many years advocated the formation of a local Post in Minnesota. In the fall of 1944, he brought together a group of leading industrialists of that area and, on March 15, 1945, due to his efforts, the new Post was inaugurated with a membership of 777.

Frank B. Winston, cofounder with Major Wilson of the new Northwest Post. Mr. Winston assisted in the enrollment of charter members and the preinaugural plans. He is now a director of the Post.

W. C. MacFarlane, president, Minneapolis-Moline Power Implement Company, a tower of strength to the Association in building its membership structure in the Northwest area. With Major Wilson, Mr. Winston, and Mr. Sweatt, he was one of the founders of the movement in that area and has given unsparingly of his time and talents to the upbuilding of the membership.

Harold W. Sweatt, president, Minneapolis-Honeywell Regulator Company, for assisting in the recruitment of members for the formation of the Northwest Post. Due in large measure to his coöperation, the new Post was enabled to start with a greatly expanded membership commensurate with the importance of industrial strength of Minnesota in the production of ordnance equipment.

NECROLOGY

Philip H. Gadsden, formerly president of the Philadelphia Post, Army Ordnance Association, and for many years chief of the Philadelphia Ordnance District, died at his home in Overbrook, Philadelphia, Pa., February 27, 1945. He was a life member of the Association, being among the first of the entire membership to enroll in this capacity. His leadership for Ordnance preparedness in the years preceding World War II had a marked effect on the speed with which American industry in the Philadelphia area undertook its gigantic task. *(Continued on p. 436)*

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In appearance and operation, the Roughness Meter resembles the Profilometer except that it enables the measurement of surface irregularities so widely spaced as to be beyond the range of the Profilometer, generally used on smoother surfaces. The Roughness Meter employs a hand-operated Tracer which traces the surface of the shell and gives a reading on the meter directly in terms of microinches of average roughness.

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Association Affairs

Mr. Gadsden was born in Charleston, S. C., a descendent of Gen. Christian Gadsden of the Revolutionary War, designer of the famous rattlesnake flag "Don't Tread On Me." Another of his ancestors was James Gadsden, who negotiated the Gadsden Purchase with Mexico, securing for the United States a tract of land now part of Arizona and New Mexico. He was graduated from the University of South Carolina in 1888, admitted to the bar of that State two years later, and in 1903 began his long career as a leader in the field of public utilities in the United States. After serving as president of the Charleston Consolidated Railway and Lighting Company, he began his service as vice-president of the United Gas Improvement Company of Philadelphia in 1918. During World War I, he served as chairman of the war board of the American Electric Railways Association and chairman of the Federal American Railways Commission. For nine years he was president of the Philadelphia Chamber of Commerce. In 1934 and 1935, he achieved national fame when, as chief spokesman for the utilities companies, he waged a relentless battle against the utility holding company bill, a measure intended to destroy the country's principal holding companies.

With the same vigor, perception, and industrial application which characterized his other enterprises, Mr. Gadsden, as chief of the Philadelphia Ordnance District, made marked progress through industrial preparedness for World War II. Surrounded by a capable group of advisers, he stimulated the coöperation of the leading industries of the Philadelphia area to the point where their record in this war is unsurpassed by the performance of American industry in any other area.

By the death of Mr. Gadsden, members of the Army Ordnance Association, the Ordnance Department of the Army, and industry generally are deprived of his zealous leadership.

Leroy C. Leasure, recognized Ordnance authority and for many years an active member of the Army Ordnance Association, died in Detroit, Mich., February 13, 1945. Attached to the Production Service Division of the Ordnance Department, with headquarters at Washington, he was on temporary duty in the Office of the Chief of Ordnance—Detroit at the time of his death.

Born in Findlay, Ohio, and educated in Wheeling, W. Va., Mr. Leasure was employed first by the Army Engineer Corps at Wheeling. Later he began a career as design engineer for artillery, a field in which he became prominent. For many years he was associated with Dayton A. Gurney, formerly chief engineer of the Ordnance Department, and the late Arthur Coburn. These three and other Ordnance engineers now serving in the Artillery Division became a strong influence on the design and development of modern American artillery. Their handiwork is a powerful influence for victory.

NOTICE also has been received of the deaths of the following members of the Association: H. Fletcher Brown, Wilmington, Del.; Milton E. Canfield, Los Angeles, Calif.; John L. Cochran, Monongahela, Pa.; G. F. Davis, Indianapolis, Ind.; Henry G. Ellis, Torrington, Conn.; Alfred Flint, Marlboro, Mass.; Mason C. Gaffney, Fairport, N. Y.; W. S. Griffiths, Oak Hill, Ohio; John C. Herr, Chicago, Ill.; R. V. Hicks, East Providence, R. I.; Francis A. Hubbard, Maplewood, N. J.; P. G. Johnson, Seattle, Wash.; Gordon L. Leitch, Plano, Ill.; R. E. Locher, Milwaukee, Wis.; E. F. Lunken, Cincinnati, Ohio; Maximilian MacSweeney, Philadelphia, Pa.; David E. McGuff, Camp Barkeley, Tex.; Benjamin Nields, Cleveland, Ohio; Oswald H. Noble, Cincinnati, Ohio; Charles D. Owen, Passaic, N. J.; W. S. Pepperell, Greensboro, N. C.; Albert E. Robinson, Cincinnati, Ohio; Joseph F. Shepherd, Dayton, Ohio; William G. Volkmann, San Francisco, Calif.; Sidney D. Waldon, Hamilton, Ohio; John B. Watt, Haverford, Pa.; and A. C. Zimmerman, Rochester, N. Y. To their relatives and friends, ARMY ORDNANCE, on behalf of the Association membership, extends condolences.

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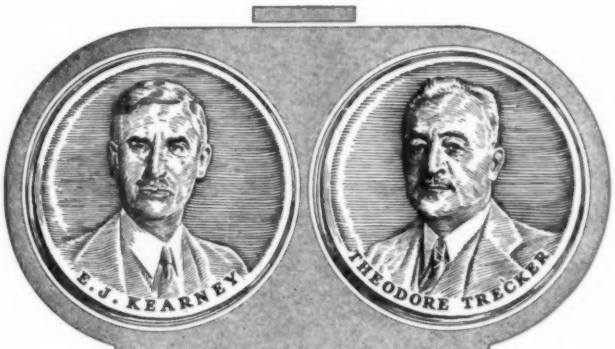

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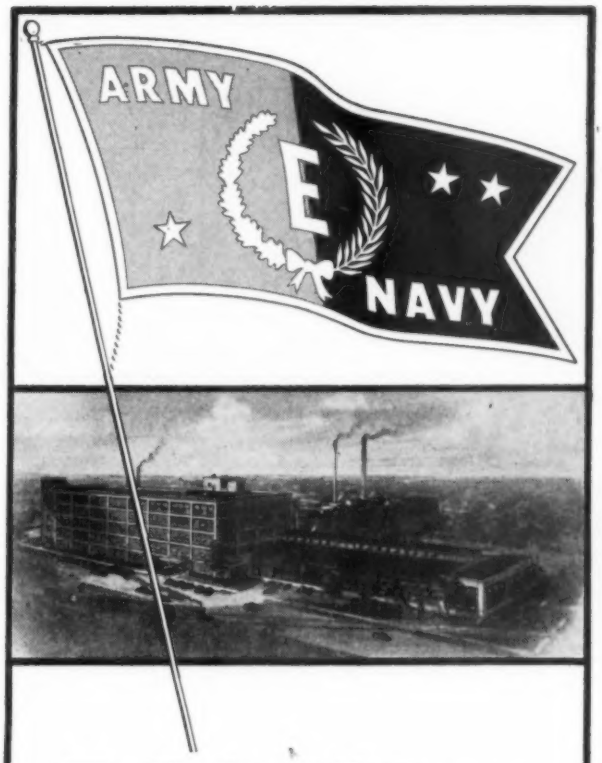

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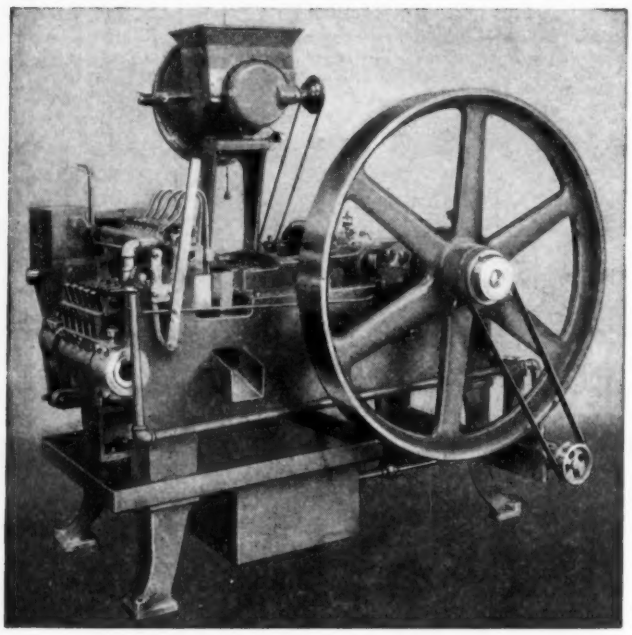

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PROFESSIONAL DIGEST

THE AUTOMATIC CARBINE M2

It can now be disclosed that the Army and Marine Corps are being equipped with the new automatic carbine M2 which will replace the M1 carbine as the standard weapon of this type.

As originally developed in 1941, the caliber .30 M1 carbine was intended as a replacement for the pistol. The carbine weighed less than 5½ pounds and had a magazine holding 15 rounds. As this weapon came into extended use, a better sight was called for and promptly manufactured. It then became apparent that a bayonet could be used to advantage, and by a slight modification the standard trench knife was made to serve a dual purpose. A grenade launcher was subsequently developed, and the carbine became capable of filling all the missions of a rifle at short range.

As the pace of the war accelerated and as our troops encountered new types of terrain and new enemy tactics, the need for more firepower was foreseen. Anticipating this need, a further development of the carbine was started by the Ordnance Department in May 1944. Twenty-one days later, a modification had been accomplished by which full-automatic fire could be delivered by the carbine at the rate of 750 rounds a minute. By reverse movement of the selector, semiautomatic fire, as in the original model, was also possible.

The only visible evidence of change in the M2 carbine is the selector. About two ounces of weight have thus been added to the weapon with but slight alteration of the basic mechanism.

Results of tests in the United States were so satisfactory that 500 preproduction models were immediately ordered for extended service tests under combat conditions. Theater commanders were advised of the new development, and, within a period of 4 weeks, 500 of the new carbines, made in job shops, were in combat theaters. During the modification period, Army Ground Forces and the Marine Corps conducted extensive engineering and tactical tests and recommended that the new carbine replace the M1.

The M2 carbine, as it is now called, was made a standard weapon in September 1944, just four months after the project was initiated. Production was accelerated, and today the little weapon with the big punch is being shipped in ever-increasing numbers to front-line troops.

INVASION LOGISTICS

More Ordnance equipment and supplies were landed on the European Continent in the seven months following D-day than had been previously built up in the British Isles over a period of two years. From June 6, 1944, to December 31, 1944, more than 2,000,000 long tons of supplies of the Ordnance Department were landed at the ports and on the beaches of continental Europe. January 1945 tonnage figures, when final totals are added up, promise to break all existing records.

Maj. Gen. Henry B. Sayler, Chief Ordnance Officer of the European Theater of Operations, recently cited the following examples of the rapid way in which Ordnance matériel is being used up:

In December, when U. S. forces were battling Von Rundstedt's counteroffensive, ground troops expended approximately 2½ times as much ammunition as was used in the month of July to achieve the decisive break-through at St.-Lô in France.

The XX Corps, which successfully assaulted the almost impregnable German fortified positions in and around Metz, France, expended over 1,000 tons of ammunition daily for 10 days to attain its objective. Artillerymen of one field battalion recently poured out 7,043 rounds in 2 days from their (*Continued on p. 440*)

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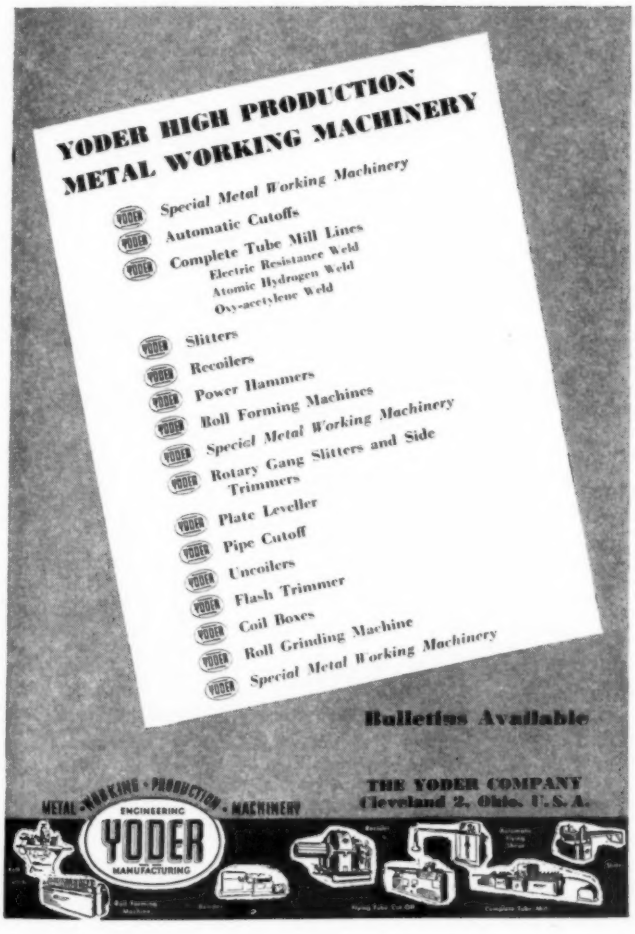

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Yet, strangely enough, the tractor they call "Queen Mary," after one of the biggest ships afloat, is the *smaller* of two sizes of military tractors that have been rolling out of the Autocar factory in increasing numbers all through the war. Heavy loads and heavy going mean little to Autocar two-, four-, or six-wheel-drive trucks and tractors.

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Unexpected, that is, by Hitler, Himmler, & Co., who a few short years ago saw their victory at hand. And now, M-4 tanks and M-7 "tank destroyers" with hulls by Fitzgibbons, slam through rubble-piled, lanes of German villages, their wary "mg's" watching every window and cellar hole, their powerful heavy guns and howitzers in hair-trigger readiness for possible armored resistance.

Unexpected, too at the peaceful Fitzgibbons plant, where so many of the hulls were—and are—made for these M-4 tanks and M-7 gun carriages. Where pre-Pearl Harbor welders were peacefully joining steel boiler parts to fight the thermometer, and are now welding slabs of heavy steel tank armor to deliver the knockout punch to the doomed defenders of the Crooked Cross.

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105-mm. howitzers—an average of one 33-pound projectile every 25 seconds. This adds up to 116 tons of projectiles, not counting the powder charges and shipping containers which also had to be moved from home-front factories to the fighting front.

Ordnance weapons, including combat vehicles, supplied since D-day in Europe total more than 300,000 long tons—almost half of which were tanks. Hundreds of thousands of cargo and passenger vehicles are needed to transport men, their weapons, ammunition, and other supplies to the front. These, too, are an Ordnance responsibility, and the aggregate supply since D-day has been close to 500,000 long tons.

About one-third of all the general-purpose vehicles in the European Theater of Operations have a carrying capacity of 1½ tons or less, and include a number of jeeps. Another third are heavy-duty trucks, including the Army's work horse, the 2½-ton truck, and still heavier types. The rest are trailers of many kinds which serve to increase the over-all carrying capacity of our motor transport.

Ordnance service maintains all the foregoing items by salvage and repair in the field. To do this job, huge stores of spare parts and equipment must be supplied for the use of Ordnance repair crews. These supplies—the life blood of maintenance—have totaled 250,000 long tons since D-day. For example, 100,000 firing pins are needed each month for carbines and rifles alone. Other typical monthly requirements are 70,000 spark plugs and 50,000 sets of distributor points. More than 500,000 gallons of antifreeze have been supplied our troops. The attrition on tires and tubes requires up to 200,000 replacements monthly.

CONTRACTOR TRAINING TEAMS

War contractors and their representatives throughout the country can now receive free instruction in definite contract-settlement procedures. The War and Navy Departments have organized eighteen teams of experts for conducting settlement courses in major manufacturing and industrial areas. Each team consists of four members composed of officers of both Army and Navy. One man acts as an advance secretary.

This intensive course of training will consist of a 4-hour settlement work session dealing entirely with the filling out of settlement proposal and inventory forms. The war contractors will be given a complete representative termination case with all necessary facts and figures. Forms pertinent to the case will be filled out by the contractor in the classroom under the supervision of the instructors.

In order to test what the students have learned, at the end of the work sessions a typical problem is given in the form of an examination involving the filling out of settlement proposal forms. The students are given all the necessary data and are told to work out the problem. They are given an approved solution to a similar problem which they may use as a guide in preparing their own forms.

It has been pointed out by the Army that war contractors will not be able to clear their plants and accept other war work following a termination unless an inventory has been prepared. Moreover, contractors cannot receive final payment until they have filed an acceptable claim. The course is directed in the main at smaller war contractors.

Both Army and Navy officials in contract-settlement work are enthusiastic about this new training program and state that they believe it will answer many of the problems which heretofore have been the cause of the delay in submission of claims. At the present time, approximately sixty-five per cent of the dollar value of terminated Army contracts alone remain unsettled because contractors have failed to submit proper claims.

Teams will operate in the following areas: New York, Boston, Philadelphia, Springfield, Cleveland, Buffalo-Rochester, Cincinnati-Dayton-Columbus, Pittsburgh, Chicago, Detroit, Minneapolis-St. Paul, St. Louis, San Francisco, Los Angeles, Seattle, Dallas-Fort Worth, Atlanta-Birmingham, and Kansas City.

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Ballistics

A New Work by Townsend Whelen

Lieut. Col. Calvin Goddard

THE recent publication of the first volume of Townsend Whelen's new 2-volume work on "Small-Arms Design and Ballistics" (Plantersville, S. C.: Small-Arms Technical Publishing Company, 352 pp., $6.00) is an occasion of especial interest among the small-arms fraternity everywhere. When Colonel Whelen's book, "The American Rifle," appeared in 1918, this reviewer was a verdant young lieutenant in the Regular service, with liquid assets skimming zero by reason of the outlay involved in the recent acquisition of a military wardrobe—several varieties of "blues" included. The price of the book, which as I recall was six dollars, was therefore sufficient to give pause to one in very straitened circumstances—particularly to one who had never before paid such a stupendous sum for a book!

But Whelen then was, and still is, a name to conjure with among practical riflemen as well as among those less fortunate souls like myself who, for one reason or another, rarely get to a range and so must content themselves with being "armchair experts." Accordingly the outlay was made—and has never been regretted.

In the years which have elapsed since the appearance of "The American Rifle," Colonel Whelen has consistently been prominent among contributors to the literature upon small arms. To his credit are several formal volumes, notable among these "The Hunting Rifle" (New York, 1940), and scores of lesser efforts such as instructional handbooks, articles in sports magazines, and so forth. During all this time he has kept his eyes open and his ear to the ground. Little worthy of record has taken place in the small-arms field that has escaped his attention or that has not been noted on an index card in his files.

As a result, Whelen stands today as the Delphian oracle, the Nestor, and the patron saint of the American rifleman. He has forgotten more about small arms and ammunition than most of us shall ever know. He knows more than he will ever be able to set down for posterity.

Now he has skimmed the cream from his brimming cup of knowledge to give us the benefit of his years of careful observations, meticulous tests, painstaking recordings. He has made it possible for any reasonably well educated American stricken with "gunitis" to become well informed upon practically every topic with which he need be conversant in order to understand the whys and wherefores behind the development and use of the rifles, pistols, and shotguns of today and the factors which determine their capabilities and their limitations. Perhaps the happiest part of the picture is that, though the word "ballistics" figures in the title of his new volume, one looks in vain for the terrifying series of formulas and equations commonly associated with that word. They just aren't there.

The present work is divided into twelve chapters and a brief (4-page) subject index. The last is unsatisfactory because of its limited coverage. As an example, "dumdum" bullets are discussed on pages 301, 302, and 303 of the text. Several hundred words are devoted to the story of the development of the only and original "dumdum," a tale well worth the telling, because known to so few. Yet the word "dumdum" does not appear in the index, nor is there any other index title through which it may be traced. More serious, however, is the complete omission of the appendix referred to on page 15 of the text as con- (*Continued on p. 444*)

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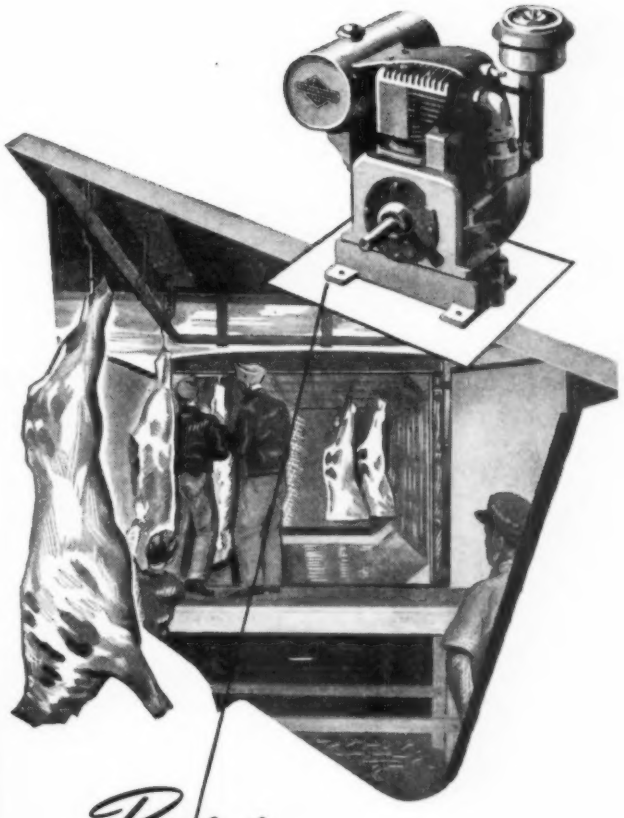

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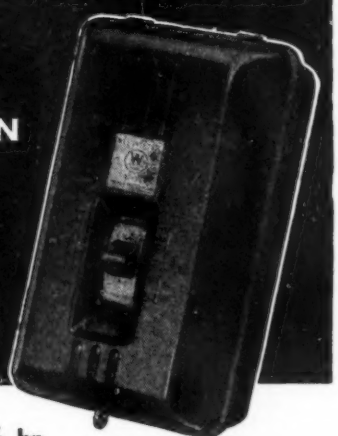

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taining "American rifling tables." Let us hope that these missing data will be found in Volume II, to the appearance of which we look forward.

The first six chapters of the book are devoted to the weapon and its major components and attachments—barrel, action, stock, and sights; the last six to the cartridge and its components—bullet, powder, case, and primer. And I venture to say that no chapter will fail to present some bit of information, new and useful, to the most experienced rifleman, while for the tyro hardly a page but will have one or more messages of interest. Indeed the work, despite its moderate size, is nothing short of encyclopædic in its coverage.

In addition it is extremely readable, and, better still, with the few exceptions noted hereafter, it is unimpeachably correct. Which brings to mind a British arms author who is so much without honor in his own land that his fellow Englishmen have a saying: "If you see it in 'Jones,' it's *wrong!*" *Per contra*, it's a pretty safe bet that if you see it in Whelen—it's *right!*

THE few exceptions to the above rule which I noted in scanning the present volume, plus certain other questionable constructions, include the following:

Page 21: "The weight, that is the outside diameters, of the barrel of a small arm depends on a number of things." The meaning of the above sentence is unduly obscure. It could be conveyed much more simply.

Page 50 (last paragraph): "After a new rifle . . . has been proof-fired it must not accept this 1.943 gage . . ." *Page 52* (top): "After the rifle has been proof-fired, the bolt should close down easily on the 1.943 gage . . ." Plainly, reconciliation of the above statements is in order!

Page 106: "It [the Garand] was adapted [*sic*] as the standard infantry rifle in 1939." The correct date is 1936.

Page 114: "Extraction is one of the principle problems." I prefer "principal."

Page 154: "The rim-fires were the first successful metallic cartridges for rifles and revolvers . . ." Correct, if we modify by adding "in the United States." Otherwise the pin-fire ignition must be given precedence.

Page 184 (Fig. 58B): "This shows the Martin primer . . ." The primer shown is of the "cup" type, not a Martin, which is wholly different. For illustrations of Martin primers, see Plates XIX-XXII, inclusive, "Ordnance Memoranda No. 14," Government Printing Office, 1873.

Page 191: "Berdan primers . . . have been made only experimentally or on foreign contracts in America." True, if we consider recent years only; untrue as applied to the early days of metallic-cartridge manufacture in the United States.

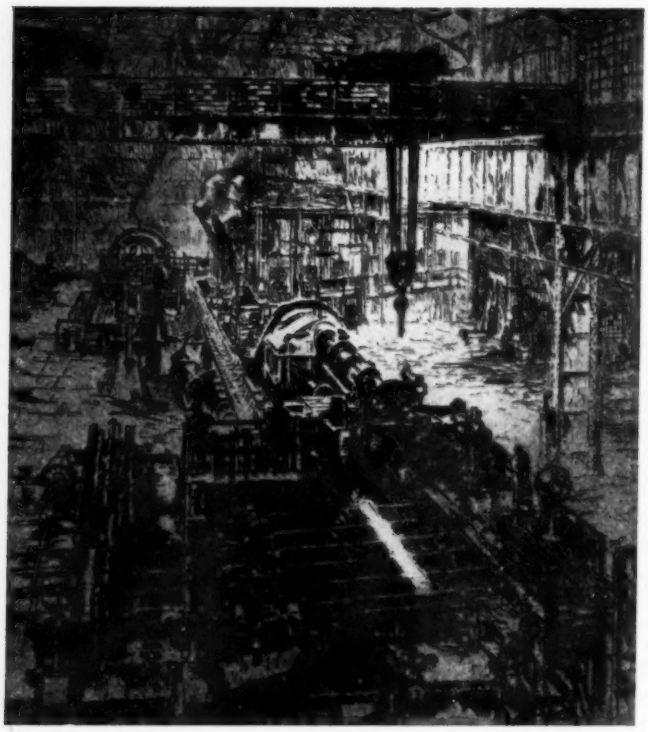
Page 204: ". . . Japanese 6.5-mm. Arasiki cartridge . . ." The conventional spelling is Arisaka.

Page 221: Confusion in re "Martin" primer (or cartridge) is here repeated.

Page 242: "The top wad over the powder is omitted . . ." "Powder" is here used in error for "shot."

Pages 273-274: Seven currently used shotgun smokeless powders are described. In the case of three of these by direct statement, and one more by implication, the shooter is warned against loading them into shells to be fired in Damascus barrels. Is the use of the other three in such barrels permissible? No; but by failure specifically so to state, misinterpretation may readily develop.

Page 293: "Only a few jackets of mild steel were produced experimentally in the United States . . ." This is a sore point with the reviewer, who used to express a similar opinion, until he was "exposed" by a fellow writer. Actually, steel jackets in considerable numbers were produced and sold commercially in 30/40 caliber.



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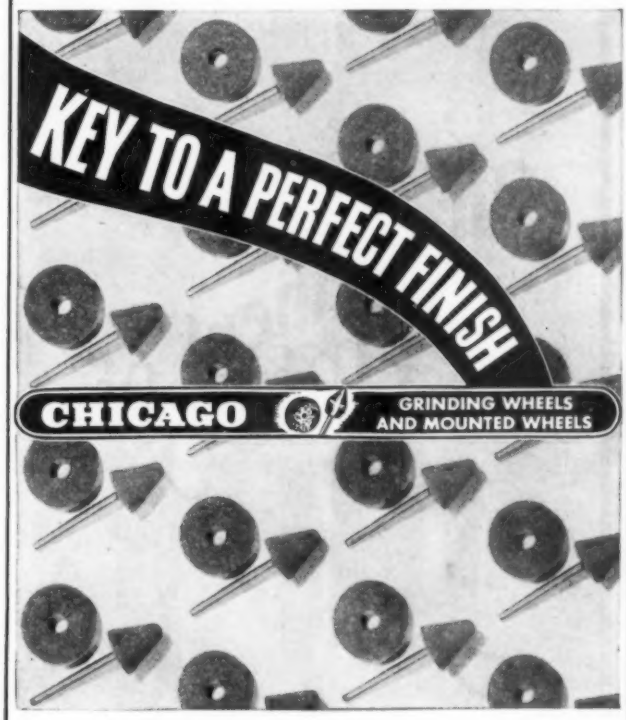

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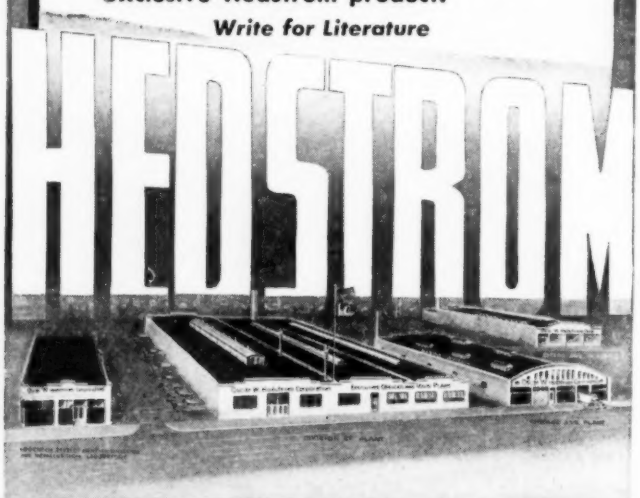

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Automotive Maintenance

THOSE LUBRICATION ORDERS

In line with the Army's policy of improving the efficiency of operations wherever and whenever possible, a new system of distributing War Department Lubrication Orders (WDLO's) is being put into effect. The system is intended to make distribution of these important maintenance forms automatic so that no piece of equipment is operated without them.

However, since no distribution system on such a large scale as that of the Army can be expected to be one hundred per cent effective, and since the distribution within individual units must of necessity be left up to officers of the unit, it is important that officers know at all times which WDLO's are available and how to obtain any copies they may need.

It often happens that in the distribution of WDLO's by The Adjutant General, because of frequent organizational changes the unit commander will find the number of copies allotted to his unit does not fill its requirements, so he will have to requisition copies in addition to those originally received. Then, too, copies will be lost or destroyed or worn out.

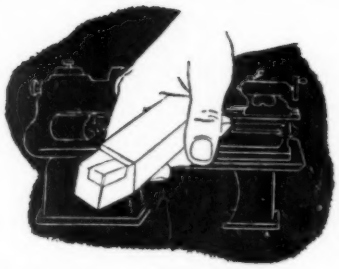
Under the new system, the WDLO for a piece of equipment is placed in the same classification as the equipment's technical manual. It is given the same distribution as the manual, and, to make identification simpler, it carries the same number, except that the letters "LO" replace the letters "TM." For example, the technical manual TM 9-772 and the lubrication order LO 9-772 pertain to the same piece of equipment. Incidentally, although old-style lubrication orders will be superseded as rapidly as possible by the new-style ones (metal-bound cards are out, and only the decalcomanias and ordinary cards will be issued from now on), the former should continue to be used and requested until the new-style replacements are received or are listed in FM 21-6, "List of Publications for Training."

This publication makes it easy to keep posted on the new WDLO's, for it comes out once a month, lists all WDLO's available, and marks those issued during the past month with an asterisk for quick identification. In addition to listing the WDLO's, FM 21-6 describes them, specifies how they are to be used, and tells how the necessary extra copies may be obtained. It is mandatory that each piece of equipment be accompanied by its WDLO at all times (see Cir. No. 114, W.D., 1944) and it is the officer's responsibility to see that this is carried out.

HERE there are two important points that should be strongly emphasized. All too frequently it will be found that a complete file of WDLO's is kept by the sergeant major of a unit when the equipment maintenance men do not have copies to work with. Inasmuch as WDLO's are *work* sheets, placing them in a file serves no useful purpose, and this practice must be stopped. It is the sergeant major's responsibility to see that the WDLO's he receives are *distributed* to the men who need them.

The other point that should be kept in mind is the fact that WDLO's must be constantly checked to make sure that the current one for every piece of equipment is being used. Here again, reference to FM 21-6 is important in checking WDLO's available for issue so that obsolete copies may be destroyed and replaced. In this regard, the enlisted man should feel no hesitancy in reminding the responsible officer of his requirements if WDLO's are not forthcoming when they are due.

Now is a good time to check up on your WDLO's. Correct lubrication is a contribution to victory.



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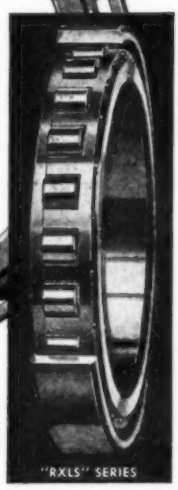
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ORDNANCE IN REVIEW

The Walther P38 German Pistol

Melvin M. Johnson, Jr.

IN addition to numerous other developments brought out during World War II, the Germans have extensively used the so-called P38, or Walther military automatic pistol. Chambered for their widely favored Luger pistol and submachine-gun cartridge, the 9-mm. with 124-grain bullet at 1,100 foot-seconds' muzzle velocity, the Walther is not only the successor to the well-known German Luger pistol but is also the most modernized type of automatic pistol used in this war.

In comparison, the United States is still employing the famous Colt (Browning patent) automatic pistol, Models 1911 and 1911A1, in caliber .45—a weapon of superior reliability and stopping power. The Japanese are using a Model 1925 automatic pistol which is sometimes called the Nambu, although the original Nambu was actually its predecessor in time. The Japanese pistol uses a rotating hinged lock and a short-recoiling barrel. It is rather a crude weapon and is chambered for the Japanese low-power 8-mm. cartridge. The Jap 102-grain bullet at 900 foot-seconds can hardly compare with the Colt's 230-grain bullet at 830 foot-seconds.

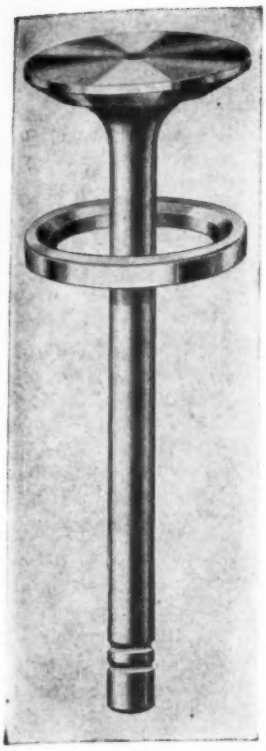
The Russians use the Tokarev, which is a conventional medium-sized automatic pistol of the Browning type. The Polish Government, in coöperation with the Fabrique Nationale of Belgium, shortly before the war developed an improved Colt-Browning system in the Radom automatic, chambered for the 9-mm. cartridge. This weapon has certain refinements and simplifications over the Colt Model 1911. The British have clung to the revolver in caliber .38, with break-open or tip-up action. A great many revolvers are actually being used in the war as personal sidearms, more especially the U. S. Colt M1917, and Smith & Wesson M1917 caliber .45 revolvers.

Consequently the German Walther, or P38, stands out as perhaps the latest type of automatic pistol. This is regrettably characteristic of all German small arms, and, as might be expected, the Germans were working on this pistol for some years before the war. In fact, one commercial organization in New York City advertised this pistol in its catalogue of small arms as early as 1938.

The Germans have bluntly disclosed many of their developments of this sort and have told the world all about them. There is a certain subtlety about their method. They are quite capable of keeping secret anything which is capable of being kept secret, but on items such as small arms they have usually spared no effort to broadcast most of the essential details, knowing full well that none of the allied nations would ever pay any serious attention to them.

ONE of the functions of this column is to follow a utilitarian pattern of analysis in discussing weapons. ARMY ORDNANCE magazine is certainly not a catalogue for gun collectors, nor is it a medium for the collection of footnotes out of history. It is rather an ordnance journal for soldiers, designers, and manufacturers—people who are working actively during the present war to build up safeguards for future peace. Consistent with the policies of the Army Ordnance Asso- (*Continued on p. 450*)

Mr. Johnson is a leading authority on all types of firearms, having invented several pieces. He holds a commission as captain in the U. S. Marine Corps Reserve.



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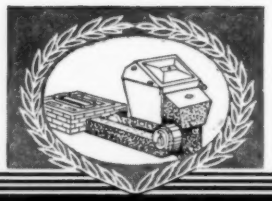
1918  1943

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ciation, it will therefore be understood that in discussing such a weapon as the Walther pistol we are doing so on the basis of practical criticism. In other words, what has this gun got that other guns do not have, what might it have that it does not have, and, in general, what can we learn from it to improve our own approach to the problem of providing a weapon of this type.

Briefly, the P38 is a 9-mm., 8-shot, short-recoil-operated, medium-weight, self-loading pistol with exposed hammer and unique safety features. The locking action is of the hinged, rising-block type. The lock is cammed down during the initial recoil of the barrel. The action is superior to the Luger's, eliminating the toggle action which causes so many failures to lock unless the Luger is well lubricated. Unlike the Colt .45, the barrel stays on its own axis at all times and is not cammed downward. The P38 weighs about thirty-four ounces, or about five ounces less than the Colt .45. The barrel is 4¾ inches long, and the over-all length of the pistol is 8½ inches.

Although the grip is at a slight angle, it is the writer's opinion that the Luger feels better in the hand than the Walther. It is possible that the Germans found a lot of green troops shooting too high with the Luger, whereas the P38 tends to shoot a little lower if it is pointed rapidly by an uninitiated person. But there is a more fundamental reason for the shape of the grip. It is because a perpendicular grip permits better feeding of the cartridges through the magazine than one which requires a sharp angle, as does the Luger. The question of reliability of function has entered into the design of the Walther as regards the angle of its grip.

Field stripping of the Walther is unusually simple, and it is in that respect easier to handle than the Colt .45. Primarily, it is only necessary to turn the locking pin on the left side of the gun ahead of the trigger guard and pull out the barrel and slide. The barrel is readily disengaged from the slide. That is all the stripping required for ordinary field cleaning and care.

The magazine latch is on the bottom of the handle, and in that respect the magazine is not as quick to change as that of the Colt .45. The slide stays open when the last shot is fired. The thumb safety is on the left-hand side of the slide in approximately the same position as on the Colt .45, although on the Colt the safety is closer to the thumb. The grips are made of composition material rather than of wood, and the back of the grip is well shaped to fit the hand.

THE great disadvantage of automatic pistols is the fact that when a cartridge is carried in the chamber it is necessary either to have the safety on, at best a dubious locking means, or in the case of military pistols with an exposed hammer, such as the Colt .45 and the Walther, to have the hammer in the forward or uncocked position. This means that when the pistol is hastily drawn from the holster the operator must cock the hammer, or otherwise he must carry the pistol in a relatively dangerous manner, having the thumb safety on and the gun cocked.

Another disadvantage of the automatic pistol over the revolver is the fact that in the revolver if the primer misfires it is only necessary to pull the trigger again on double action in order to fire the next cartridge. In the case of the automatic, if it misfires, the gun has to be recocked. Consequently, many people prefer the revolver because after all it is a close-range weapon, and when they want it to fire they do not want it to do anything else but just that.

The Germans must have spent considerable time thinking of these problems, and the result of their research and study is found in the P38. Briefly, the P38 is unique in its trigger and hammer action. The trigger can be worked in double action—cocking and releasing the hammer—while at the same time it normally functions in the conventional manner, releasing the hammer after it has been cocked either (*Continued on p. 452*)

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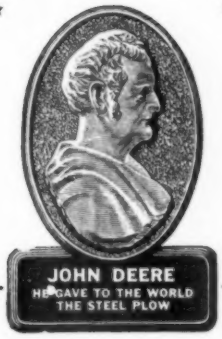

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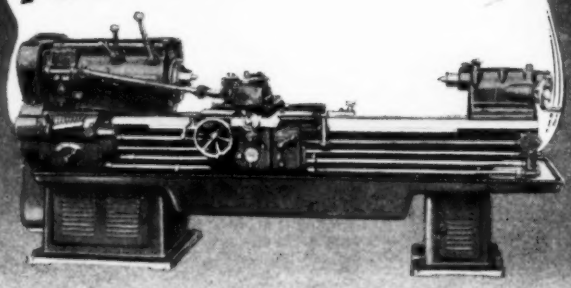

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by hand or by the function of the gun after automatic loading.

Lest it be assumed that this German double-action design in an automatic pistol is entirely new and novel, the following pistols, with approximate dates of origin, all embodied the double-action principle in various forms: *Mannlicher,* 1894; *Knoble,* U. S. experimental, 1906; *Roth-Steyr,* Austrian Army, 1908; *Française Armes,* French commercial, about 1928; and *Walther,* commercial model, about 1928.

Starting with an empty Walther P38 pistol, slide closed, the operator inserts a loaded magazine into the grip. He then pulls the slide fully rearward and releases it. This chambers a cartridge and leaves the gun cocked ready to fire. Suppose, then, that the operator wants to carry the gun in the holster with the hammer down. He may do one of two things: Either he can let the hammer down with his thumb or he can throw the thumb safety on the left side of the slide from its horizontal position down to its vertical position. When the safety is thrown down to the safe position, the hammer will fall forward, but the gun will not fire.

In order to fire the gun, the operator must throw the thumb safety to the fire position. Then he must give the trigger a long, double-action pull. This double-action pull will cock the hammer and then release it, all in one pull. But the operator might have dropped the hammer down to the uncocked position either by manual operation of the hammer or by throwing the thumb safety. The operator might then throw the safety back to the fire position which would leave the hammer down and the gun safe. In order to fire the gun, the operator would then draw the gun from the holster and give the trigger a long, double-action pull.

ONE advantage of the double-action pull would be that the gun might misfire. If the trigger were pulled and the gun did not fire, the operator could keep on pulling the trigger on double action to try and make the cartridge fire. Perhaps it might fire on the second or third try. Very often, however, if the cartridge does not fire the first time, it never will fire. If it does fire on a second or third try, the trigger mechanism and hammer are probably weak, improperly adjusted, or dirty.

The price that is paid in complicated devices to obtain a double-action pull may not be worth the gain incorporated in this weapon. That can be argued eternally. Nevertheless, the Walther or P38 German pistol stands unique among modern pistols as the only one of its type in service use to have this feature.

It might well be argued that one good rugged safety, capable of locking the trigger, absolutely locking and blocking the hammer, and readily accessible to the trigger finger, would be an improvement over this design. Nevertheless, if the gun did not fire and you had to recock it to try again, it might be an advantage to have the double action. Otherwise, the best method is to give the slide a quick pull and chamber another cartridge.

The mechanical reliability of the P38 is probably less favorable than the Colt .45, M1911. In any recoil-operated weapon, a heavy bullet provides a more positive action than a light bullet. The caliber .45 bullet weighs 230 grains, or almost twice as much as the 9-mm. bullet, which weighs only 124 grains. The .45 bullet is, of course, in the 800-foot-second zone of muzzle velocity, whereas the 9-mm. is 1,100 foot-seconds. Nevertheless, the caliber .45 Colt pistol cartridge has much more recoil energy which can be stored up in the slide and mainspring.

The operating slide of the Colt is heavier than that of the Walther. The Colt slide surrounds the entire barrel over the full length, whereas that of the Walther does not. On the other hand, the Walther is neater, more compact, and probably better-balanced than the Colt. The accuracy of the Walther should be favorable. It is, of course, a close-range, European-type pistol. It is designed for firing at ranges of a few feet up to possibly twenty-five yards. But the 9-mm. cartridge cannot compare for stopping power with our Colt .45 load.

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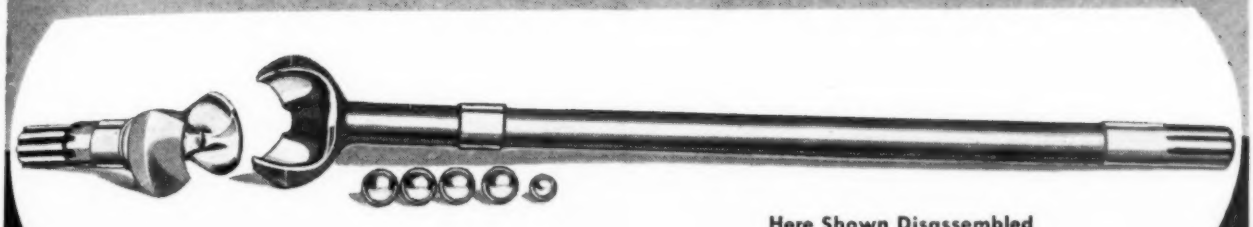

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BOOK REVIEWS

SMITH & WESSON HANDGUNS. By Roy C. McHenry and Walter F. Roper. Huntington: Standard Publications, Inc. 233 pp. $7.50.

SINCE the publication in 1940 of Haven and Belden's "History of the Colt Revolver," students of small arms have anxiously awaited the appearance of a similar volume on the products of America's second oldest and no less renowned makers of hand firearms—Smith & Wesson.

The Smith & Wesson book is here. While not so comprehensive as the Colt volume, it contains about all the essential facts concerning the products of the firm which, even more than the famous Government small-arms manufactory in the same city, has made Springfield, Mass., a hallowed spot to the handgun devotee. For such, the work will have "triple-A" priority when accessions to the arms library are under consideration.

Approximately the average number of errors in statement of fact, spelling of proper names, confusion of one object with another, labeling of plates, etc., is encountered. Not sufficient effort is made to clarify matters which must appear obscure to the average reader. Thus we read on page 45 that the Rollin White patent, issued in 1855, expired in 1869. Most of us know that United States patents have a life span of seventeen years. The observation that until 1870 the figure was fourteen years could well have been added for the information of the layman.—C. G.

THEY CALLED IT "PURPLE HEART VALLEY." By Margaret Bourke-White. New York: Simon & Schuster. 183 pp. $3.

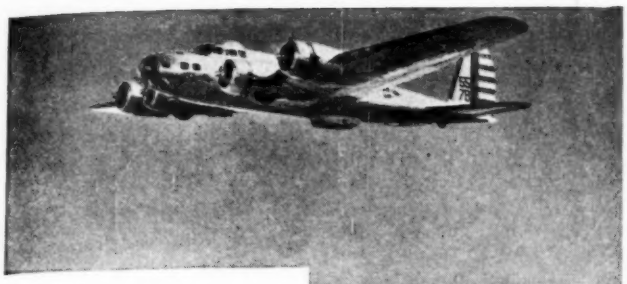
THERE is a valley near Cassino where so many American soldiers were killed or wounded that they call it "Purple Heart Valley." Margaret Bourke-White wandered through this valley, and through many another place of danger, to see with her own eyes and to record with her camera what the war in Italy was like. Her words and her pictures are equally vivid in depicting the difficulties of the road to Rome.

Miss Bourke-White describes the fighting troops, but she also tells much about the men who, just behind the front lines, bake the bread, build the roads and bridges, repair the guns, supply the ammunition, and do the other military chores that support the infantry-artillery-tank team. Probably these comparatively unheroic but herculean duties appear dull to observers. Certainly to write as well about these men as about the spectacular airman and doughboy requires greater skill. But that is precisely the quality that Miss Bourke-White exhibits in this book.

With an artillery observer she flew in a little unarmored Cub plane over the German lines. She accomplished her mission at great personal risk, and our war reports are richer because of her courage, keen observation, and ability to tell a good story. Most of the details she describes are missing in other war reports. The book is extremely readable, and it would have been most acceptable without illustrations. Her magnificent photographs make it one of the best war records published to date.—D. A.

THE VIGIL OF A NATION. By Lin Yutang. New York: John Day Company. 262 pp. $2.75.

THE "open-door" policy in China, which the last generation of Americans thought of as a diplomacy highly desirable to defend, will be completely dead at the (*Continued on p. 456*)



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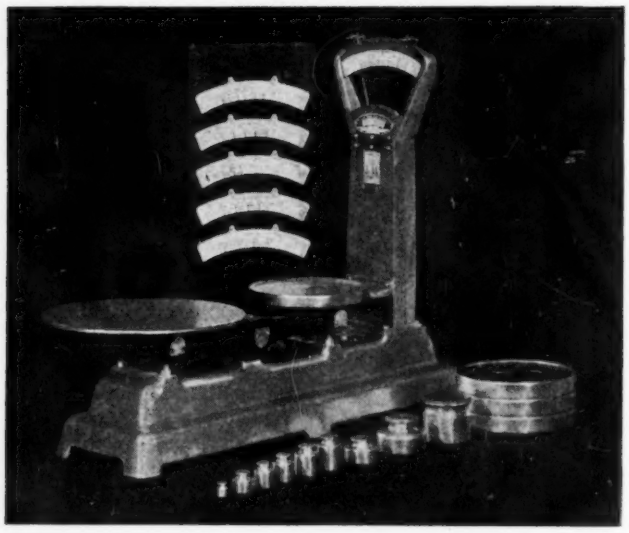

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end of this war. Looking back at it now, the "open door" meant that the door of the house was to be kept open for any one to go in at any time, but that the owner was to have nothing to say about the quality or the actions of the visitors. But in the seven years of the Chino-Japanese War, the world has learned that the house of China has an owner who is competent to be a citizen of the world with human rights over his own house.

The author is a true philosopher, and his insight into American character has enabled him to prove that it is possible for East to meet West and understand each other. In the opinion of Mr. Lin, the bamboo age is over in China, but it will be a long, difficult road to the attainment of the steel age and will need the sympathetic coöperation of the American people. Neither the American interpretation of "democracy" nor the Russian view of "communism" will ever truly fit the Chinese people who love their personal and family freedom of action, yet have no desire to exploit the common resources for the benefit of the few gifted ones.

The Chinese peoplé have suffered terrible hardships for seven years of war, but in their desperate poverty they still maintain the highest human qualities. If we knew the Chinese people better, we would do more for them. This book should be read by every thinking American.—G. S. B.

AIRCRAFT ARMAMENT. By Louis Bruchiss. New York: Aerosphere, Inc. 240 pp. $6.

THIS work presents all available material to give the ordnance specialist, aircraft engineer, manufacturer, and the student of modern warfare an extremely valuable treatise on armament aloft. It describes and illustrates this phase of ordnance under these headings: early history, bombs, machine guns, cannon, ammunition, turrets, armor protection, enemy aircraft weapons, antiaircraft, aërial and antiaircraft gunnery training, future air weapons and air warfare, including a glossary. The current importance of this work is undeniable and will be most interesting reading matter for the aviation-ordnance enthusiast.—H. P. H.

BOOKS RECEIVED

ARE MEN EQUAL? By Henry Alonzo Myers. New York: G. P. Putnam's Sons. 188 pp. $2.50.

MANAGEMENT OF INSPECTION AND QUALITY CONTROL. By J. M. Juran. New York: Harper & Brothers. 233 pp. $3.

THE WORLD AT WAR. Washington: *The Infantry Journal.* 416 pp. $0.25.

THE MILITARY STAFF—ITS HISTORY AND DEVELOPMENT. By Lieut. Col. J. D. Hittle. Harrisburg: Military Service Publishing Company. 201 pp. $2.

SPLICING WIRE AND FIBER ROPE. By Raoul Graumont and John Hensel. New York: Cornell Maritime Press. 114 pp. $2.

TWO HUNDRED THOUSAND FLYERS. By Willard Wiener. Washington: *The Infantry Journal.* 196 pp. $2.75.

HOW TO HANDLE LABOR GRIEVANCES. By John A. Lapp. Deep River: National Foremen's Institute, Inc. 290 pp. $4.

AMERICAN MALLEABLE IRON. Cleveland: Malleable Founders' Society. 367 pp.

QUALITY CONTROL. By Robert J. Wilkie and John A. Harrington. Des Plaines: DoAll Service Company. 140 pp.

PSYCHOLOGY FOR THE RETURNING SERVICE MAN. Edited by Irvin L. Child and Marjorie Van de Water. Washington: *The Infantry Journal.* 234 pp. $0.25.

THE INDUSTRIAL HOUSEKEEPING MANUAL. By R. F. Vincent. Deep River: National Foremen's Institute, Inc. 115 pp. $2.50.

CONFERENCE LEADER TRAINING. By E. S. Maclin and P. T. McHenry. Deep River: National Foremen's Institute, Inc. 77 pp. $2.50.